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The effectiveness of alternative approaches to investigating arson: A study of one hundred and fifty-five cities

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THE EFFECTIVENESS OF ALTERNATIVE APPROACHES TO INVESTIGATING ARSON: A STUDY OF ONE HUNDRED AND FIFTY-FIVE CITIES

by

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A dissertation submitted to the Graduate Faculty in Criminal Justice in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

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Abstract

THE EFFECTIVENESS OF ALTERNATIVE APPROACHES TO INVESTIGATING ARSON: A STUDY OF ONE HUNDRED FIFTY-FIVE CITIES

by

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Adviser: Professor Carl F. Wiedemann

Because arson investigations are viewed as unique and complex, literature devotes condsiderable attention to the difficulties involved in the investigation and prosecution of cases. In many jurisdictions, the central question is the locus of investigative repsonsibility: (a) police department, (b) fire department, or (c) combination of both departments. It is generally conceded that police departments have more experience than fire departments in conducting criminal investigations and interviewing witnesses. Fire departments, however, have more expertise in determining causes of fires.

In this study of one hundred fifty-five cities it was found that the location of responsibility does not significantly affect the outcome of a successful arson investigation. The operational tactics such as reward, posting of building and use of data systems had more effect and proved more successful in arson control. It was, however, found that fire departments are more likely to use these tactics. Newer cities in the sunbelt were also more likely to use them.

This dissertation is dedicated to Dr. Edward Sagarin (Deceased), who gave his all for his students and was always there for them.

In addition, I want to thank Lavita Nadkarni for her help with the computer programming and Dr. Carl F. Wiedemann without whose help much of the research would not have been possible.

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A BRIEF HISTORY: FIRE FIGHTING & ARSON INVESTIGATION

Fire, the world's boon and bane since pre-historic times, can erupt within seconds. Within minutes -- in careless, negligent or vindictive hands -- fire can cause havoc and destruction in a home or building. Unchecked, it can spread throughout towns and cities destroying vast numbers of homes and business establishments resulting in loss of human life. As people's ability to produce quick and sometimes dangerously effective fires advanced, so did the development and growth of their cities thus spurring a need for fire control to help prevent as well as control home and life-destroying fires.

The first historical record of organized firefighting goes back to pre-Christian Egyptian and Greek civilizations.[1] Roman Emperor Augustus Caesar (24 B.C.) established the earliest known fire brigade. A watchman service was created and regulations for preventing and checking fires were issued to all citizens. Six hundred slaves, under the control of a band of citizens, comprised the early fire organization. The slaves were stationed near city gates and responded to all fires in their designated area.

Too loose and ineffective to be considered even a rudimentary fire department, the watchmen were reorganized into a Corps of Vigiles -- after a serious fire in 7 B.C. -- giving Rome its first organized fire department. In the beginning, night patrolling was the Vigiles' principle duty. Some Vigiles had duties more like those of police rather than firefighters. Nonetheless, a history of the time clearly

shows fires as a major problem with Vigiles helpful in controlling them.[2]

As slaves, these early firefighters did not have a stake in the society they protected. They were accused of being slow in repsonding to fires and of being reluctant to expose themselves to physical injury in order to save the lives and property of their Roman masters.[3]

Augustus Caesar, after a momentous fire in 6 A.D., reorganized the Corps of Vigiles creating a firefighting force more in keeping with the Roman Empire's perceived greatness. Consisting of both freedmen and citizens, the new Corps was organized into seven cohorts of one thousand men each. This force was well supplied with equipment and dispersed throughout the city. Each cohort was responsible for two of the cities fourteen wards.[4]

Organized on a semi-military basis, the Vigiles' fire officers were on the same footing as the regular army officers and paid out of the regular army treasury. Like their army counterparts, the Vigiles received a retirement pension after twenty-six years of service.[5]

The command structure was similar to the one used by departments today. The Corps were divided into seven cohorts each with its own supervising officer called a fire centurian. Each squad was responsible for patrolling and fighting fires in its own section of the city. Each man was assigned a particular task: water carrier (Aquarius), pump operator (Seponarius), etc. Fire sentinels (Nocturnes) stood watch in towers and blew trumpets alerting citizens and Vigiles of fire. The Praefectus Vigilum, charged with overall responsibility for fire safety, was considered the first fire chief.[6]

During daylight hours, Vigiles patrolled Rome's streets and enforced fire codes. They were authorized to administer corporal punishment to violators and were issued rods for that purpose.[7]

Roman law required a fire be investigated and its cause and responsibility be determined by the (Quarstionarius) fire marshal. The person responsible for the fire was brought before a magistrate where a hearing was held and punishment prescribed. For accidental fire, corporal punishment and a fine were imposed. For arson, the punishment was death by fire. Because of these penalties, the Quarstionarius was much feared and respected.[8] The Vigiles kept watch over Rome for more than five hundred years and faded from history with the city's disintegration.

No record exists of organized firefighting or fire investigation in Western Europe during the Dark Ages. Yet, history records many great conflagrations. It seems the science of firefighting, along with many of the other sciences, took a backward step with the fall of the Roman Empire. More than a thousand years would pass before the revival of firefighting.

London was probably one of the first modern cities to pass and enforce a fire ordinance after a major fire destroyed a large section of the city in 1666. The great port which contained more than one-tenth of England's population and more than half its wealth lost 13,200 houses and eighty-four churches. Over one hundred thousand people were homeless. Less than one-fifth of the city was still standing.

After the fire, Parliament passed a bill requiring all new houses be built of brick or stone with slate roofs. London's streets were widened and trades considered fire hazards were banned. An appointed board of commissioners was made responsible for enforcing fire laws and providing the city with some firefighting equipment.[9]

London's great fire hastened development of the fire engine. Known as pumpers, these early fire engines were crude pieces of equipment manned by unskilled and frequently untrained volunteers who could no more prevent a town from

burning than could England's earlier firefighters with leather buckets.

Many English fire insurance companies were financially ruined after the 1666 fire. However, some increased their business volume and established fire brigdes for policy holders' benefits. Owners of insured buildings received cast-iron plaques bearing the insurance company's symbol. Known as "fire marks", these symbols were attached to the insured building's door. The fire brigade responded to all alarms, "but, if it did not see its company 'fire mark', it would leave and let the building burn down."[10]

Though limited in purpose and effectiveness, England's private fire brigades operated for over two hundred years. In the meantime, American cities formed successful full-time paid departments that were effectively fighting fires. England and the rest of Europe soon followed suit by providing its citizenry with professional firefighting services.

FIREFIGHTING IN AMERICA

To Colonial America, with its wooden buildings and shingled roofs, fire posed a serious threat. In those days, a fire, once started, was difficult to control or extinguish. The nation's early history is rife with tales of fires in villages and never ending struggles in organizing effective fire control and prevention.

Selectmen, or other village officials, were given considerable power in fire prevention and protection enforcement as well as fire investigation. Home owners and citizens were required to observe specific laws and ordinances. Fines were levied for acts of commission or omission that may have caused a fire that raged out of control.[11]

New York City's firefighting archives -- not untypical of experience of other eastern cities -- show how the science

of firefighting and arson investigation advanced in the United States.

Firefighting began in 1648 during Governor Peter Stuyvesant's administration. The City's first fire ordinance, adopted by the Dutch Settlement of New Amsterdam, provided that fines collected for dirty chimney violations would be used to purchase and maintain fire buckets, hooks and ladders. A fire watch of eight wardens alternated all male citizens in turns on the watch. They patrolled streets from 9 p.m. till dawn. As New Amsterdam became one of America's safest cities, this provided its business people with an advantage over competitors in other cities.[12]

As the city grew, so did the problem of fire protection. In December 1737, The New York Assembly established the Volunteer Fire Department of the City of New York. It protected the property and citizens of New York for one hundred and twenty-eight years. It was reorganized after the Revolutionary War and incorporated in 1798 as the Fire Department of the City of New York.[13]

In 1825, with the opening of the Erie Canal, New York became the nation's leading manufacturing center and largest city.[14] The city's rapid commerical growth, made fire protection increasingly difficult. An extremely destructive conflagration broke out in the evening of December 16, 1835. The water supply system proved inadequate. Thirteen acres and nearly seven hundred buildings were destroyed. When property losses exceeding twenty million dollars were filed, every insurance company in the city declared bankruptcy. This catastrophe, with its aftermath of business failures, roused the city to introduce the Croton River water supply system -- the first large modern gravity-supply aqueduct in the United States. By damming the Croton River north of the city, an artifical lake made seventy-two million gallons of water available daily for firefighting and consumption.[15]

By the middle of the nineteenth century, the Industrial Revolution had introduced drastic changes in manufacturing, farming, transportation and communication methods. America ceased being merely a supplier of raw materials; it now exported a long list of manufactured goods.[16]

New York -- along with the rest of the country -- experienced the greatest growth in its history at the onset of the Civil War. No fewer than 800,000 immigrants arrived bringing the necessary skills for the nation's expanding industry. As new machines were invented, new factories emerged to produce reapers, mowers, revolving horses, rakes, two horse cultivators, rotary spades, steam fire engines. Machines were shipped throughout the United States and Europe as fast as orders could be filled. The passenger elevator, restaurant steam fans, steam printing presses and washing machines soon followed.[17]

In the early 1860's, to cope with New York City's growth and resulting fire problem, a popular plan was promoted and proposed to establish a full time paid force of firefighters similar to forces used in Cincinnati, St. Louis, Boston and Baltimore.[18] Introduction of the steam fire engine spelled doom for New York City's volunteer fire department. Led by business leaders and property owners, fire insurance companies petitioned the state legislature for a paid department as well as a full-time paid fire investigator.

> Supported by groups that included industrial firms, banks, business and property owners, and the New York Board of Fire Insurance Companies, the desired legislation was introduced in the State Legislature. Finally, on March 30, 1865, the campaign came to a successful conclusion when the State Legislature passed the law: Section 23, Chapter 249, of the Laws of 1865 which was titled "An Act to Create a Metropolitan Fire District and Establish a Fire Department Therein."[19]

In 1870, a new charter for the City of New York (Manhattan only at the time) replaced the Metropolitan Fire Department with the Fire Department of the City of New York. The department then became a municipally controlled organization, with a commissioner appointed by the mayor. On January 1, 1873, New York City limits were expanded north to the City of Yonkers and eastward to the Bronx River. In 1895, the city expanded east of the Bronx River to its present Manhattan/Bronx boundaries. The Greater City of New York was formed January 1, 1898 through the consolidation of the five boroughs as we know them today. With a population of 3,437,000 the new city was the richest and most populous in the world. As expected, it also had the world's greatest fire protection problems.[20]

THE ARSON PROBLEM

It was not the lack of firefighting ability or the fire services' increasing injuries that caused the fire service to look at itself in relation to the rest of society. Rather, it was its inability to cope with losses from suspicious and incendiary fires -- a problem not initially identified. These fires continued to grow in number and dollar losses. By 1965 losses from suspicious fires approached the one billion dollar mark. Further, most experts agree: statistics on fires reported as accidental were not accurate. Many of those "accidental" fires should have been classified as suspicious or incendiary. Experts also contend crime reports were misleading because arson, like the crime of rape, is vastly undercounted. Reasons for the inaccurate counting center around: (1) training and (2) responsibility.

Neither the police nor fire departments give line personnel the necessary arson identifying training. When an alarm is turned in, both police and fire departments respond. They remain on the scene until the fire is extinguished. The

police go back on patrol and firefighters return to the firehouse. Both are solely concerned with fire extinguishing. The outcome: neither building owner nor the person responsible for discovering the fire and turning in the alarm are interviewed. In the absence of any other apparent cause, the chief lists the fire as accidental caused by children playing with matches or careless smoking. The fire chief cannot be blamed for his actions. He has been taught his job is fire fighting and once the fire is extinguished, his job is done. If it is obvious the fire was set purposely, the fire chief assumes the police are responsible for finding the guilty person.

The police, on the other hand, believe their job is to fight crime and not that of fire expert. If a crime was committed, police contend the fire department should report it and a detective should investigate.

Some states are actively working to solve this problem. The local fire marshal who, in addition to his other duties, conducts fire prevention inspections, is assigned to investigate causes of fires that occur in his district. Since this is viewed as an added duty, most fire marshals only investigate:

1. Multiple alarm fires;
2. Fires that cause injuries or deaths;
3. Suspicious fires involving investigators called to the scene by the Fire Chief.

This lack of clarity on investigative responsibility may have contributed to the increase in fires and monetary losses over a twenty-five year period from 1950 to 1975:

Fires Classified as Incendiary or Suspicious[21]

YEAR	NUMBER OF FIRES	MONETARY LOSS
1950	5,600	$ 15,000,000
1953	7,500	22,000,000
1956	11,500	25,000,000
1958	21,000	32,000,000
1960	23,900	31,000,000
1963	30,000	55,000,000
1965	33,900	74,000,000
1968	49,900	131,000,000
1970	65,300	179,000,000
1971	72,100	233,000,000
1972	84,200	286,000,000
1973	94,300	320,000,000
1974	114,400	563,000,000
1975	144,100	633,900,000

Many experts have begun to ask "just what is involved in the investigation of a fire?" "What kind of person is needed to do the investigation?" "What kind of training and/or education will a successful investigator need?" The next chapter addresses these questions.

FOOTNOTES

[1] George H. Tryon, ed., Fire Protection Handbook, 12th ed. (Boston: National Fire Protection Association, 1962), pp. 10-12.

[2] Ibid.

[3] Henry Thompson Rowell, Rome in the Augustan Age. (Norman, OK: University of Oklahoma Press, 1962), p. 116.

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[5] William K. Bare, Fundamentals of Fire Prevention. (New York: J. Wiley & Sons, 1977), p. 3.

[6] James C. Robertson, Introduction to Fire Prevention. (Encino, Calif.: Glencoe Publishing, 1979), p. 1.

[7] Ibid., p. 4.

[8] Ibid.

[9] Geoffrey V. Blackstone, A History of the British Fire Service. (London, Eng.: Routledge and Kegan Paul, 1957), pp. 35-42.

[10] Loren S. Bush and James McLaughlin, Introduction to Fire Science. (Beverly Hills, Calif.: Glencoe Press, 1970), pp. 24-25.

[11] Clarence E. Meek, History of the Fire Department of the City of New York. (New York Fire Department, 1950), pp. 1-5.

[12] Ibid.

[13] Ibid.

[14] Madeline Sadler Waggoner, The Long Haul West. (New York: G.P. Putnam's Sons, 1958), p. 23.

[15] New York Board of Water Supply, The Water Supply System of New York. (New York: New York Board of Water Supply, 1962), pp. 4-6.

[16] Charles A. and Mary R. Beard, Basic History of the United States. (Garden City, New York: Doubleday & Co. Inc., 1960), p. 232.

[17] Bruce Catton, Glory Road: The Army of the Potomac. (Garden City, New York: Doubleday & Co. Inc., 1952), pp. 237-239.

[18] Meek, History of the Fire Department of the City of New York. p. 2.

[19] Ibid., p. 6.

[20] Ibid., pp. 6-7.

[21] "Fires and Fire Losses, 1975," Fire Journal (November, 1975), p. 19.

CHAPTER TWO

QUALIFICATIONS OF THE ARSON INVESTIGATOR

The most frequently asked question about arson is "What experience and knowledge are required of a successful fire and arson investigator?" In an article written in 1962, New York City's former Fire Marshal Martin Scott stated "a good basic education is mandatory." To understand what constitutes arson, a good investigator must also have a working knowledge of the rules of evidence and the penal code. In addition, he/she must have a basic understanding of accounting principles and a "practical knowledge of the chemistry of fires, the fundamentals of chemistry and physics, a complete comprehension of fires, and last but not least, a large portion of common sense."[1] Scott believed in an appropriate balance between knowledge and experience.

John R. Carroll's highly regarded book, Physical and Technical Aspects of Fire and Arson Investigation, adds the following to Scott's qualifications:

> Fire investigation requires the meticulous examination of piles of debris in search of clues and evidence of the origin and cause of the fire. The work entails walking thorugh burned-out stairs to the upper stories of the fire weakened structures. The debris may include heavy floor joists, sections of walls, furniture and fixtures.
>
> Since evidence of the origin and cause of the fire usually lies beneath several feet of overlying debris, the use of mechanical equipment such as bulldozers or cranes would be a useful aid. However, their use might destroy the underlying evidence; therefore, the investigator is seldom permitted this luxury. Because most

> debris is removed by hand, the fire investigator must be physically capable of heavy manual lifting.[2]

A number of arson's characteristics require investigators to take a specialized approach utilizing specific investigative resources. Arson investigations, unlike other criminal investigations, are not normally initiated by a victim's complaint or a citizen's call reporting a crime in progress. "The investigation must start at the scene of the fire where the cause and origin must be determined in order to determine if arson has occurred. Moreover, the scene of an arson fire is not simple where a crime took place, it is the corpus deliciti."[3]

It is not always easy to detect arson even though the investigator may have a thorough understanding of what constitutes arson. Our criminal law system is very broad and complex having evolved from the common law brought over from England by our ancestors into the statutory law common to our individual states and national government. As each state defined criminal behavior, it looked back to the common law as a guide. State codes are also subject to the constitutional guarantees and rights provided citizens under our form of government. As a result, though states and federal government statutes may vary in technicalities, wording is similar.

Fire investigators must have an understanding of the elements that constitute a crime and how these elements evolved. They must also possess a basic knowledge of criminal law. Without this knowledge, fire investigators would not be able to fulfill their roles.

LAWS DEALING WITH ARSON

Criminal burning has always been treated as a serious offense. The old Roman law of "incendium", though broader in scope than the common arson law, included willful burning

that endangered another's property, setting fire to cities, and causing conflagrations and rioting. A person convicted of incendium was burned alive. Under a Massachusetts statute enacted in 1652, a person convicted of arson, was executed and all of his/her goods and property were forfeited. This law was ammended in 1784 when the death penalty was imposed only for arson committed at night.

Today, depending on jurisdiction, penalties range from twenty-five years to life imprisonment if a fire results in someone's death or an explosive is used.

COMMON LAW ARSON

Today, arson is a crime against property; however, this was not always the case. Common law defined arson as: the willful and malicious burning of a dwelling of another[4] (either by day or night) making it a crime against habitation security. The definition contains four important elements:

1. Type of structure. The burned structure had to be a dwelling or be located within the common enclosure. (Other types of buildings were not the subject of arson.)

2. House of another. The structure was required to be the dwelling of another, with occupancy, not ownership being the test.

a. Thus, to burn one's own house willfully and maliciously was not considered arson. If someone else lived in the house or in a nearby house that caught fire, it would be considered arson.

b. Since husband and wife were considered one at common law, it was not considered arson for either to burn the house.

c. Burning one's own house to defraud the insurance company was not considered arson.

d. A house that was built, but not yet occupied, was not the subject of arson, even if it was willfully and maliciously burned. Occupancy, not burning, was the test.

3. Burning. Actual burning not mere scorching was, and still is, the test.

4. Intent. The words willful and malicious are used to describe a deliberate, intentional act committed without justification. Intent may also be inferred where burning is the natural or probable result of another unlawful act. Burning due to negligence was considered trespassing in the common law and not arson as it was under the Roman law.

As the Common Law concept of arson became inadequate due to its limited application, statutory law expanded the definition to include other buildings and omitted the occupancy test, making arson the crime against property as we know it today. Shops, prisons, boats, cars and public buildings are now included in most arson statutes.[5]

THE MODEL ARSON LAW

In the 1950's, The National Fire Protection Association proposed, and most states adopted or passed statutes closely related to, the Model Arson Law. This law brought about a measure of uniformity and recognized degrees of arson. The most serious of these statutes kept the common law concept of arson as it pertained to dwellings. The Model Arson Law defined principles, assessories and attempts and covered burning to defraud the insurer as a felony, not arson.[6]

Arson: First Degree

Burning of dwelling. Any person who willfully and maliciously sets fire to, or burns or causes to be burned, or who aids, counsels, or procures the burning of any dwelling house, whether occupied or vacant, or any kitchen, shop,

barn, stable, or other outhouse that is parcel thereof, or belongs to or adjoining thereto, whether the property of himself or of another, shall be guilty of arson in the first degree, and upon conviction thereof be sentenced to the penitentiary for not less than two nor more than twenty years.

Arson: Second Degree

Burning of dwelling, etc. Any person who willfully and maliciously sets fire to, etc., any building or structure of whatever class or character, whether the property of himself or another, not included in the preceding section shall be guilty of arson in the second degree, and upon conviction thereof, be sentenced to the penitentiary for not less than one nor more than ten years.

Arson: Third Degree

Burning of other property, etc. The burning of any property of any person of whatever class or character (such property being of the value of twenty-five dollars and the property of another person) shall be guilty of arson in the third degree and upon conviction thereof, be sentenced to the penitentiary for not less than one or more than three years.

Arson: Fourth Degree

Attempt to burn building or property. (a) Any person who willfully and maliciously attempts to set fire to or attempts to burn or aid, etc. any property in the foregoing sections, or who commits any act preliminary thereto, or in furtherance thereof, shall be guilty of arson in the fourth degree and upon conviction thereof shall be sentenced to the penitentiary for not less than one nor more than two years or fined not to exceed one thousand dollars.

Definition of an attempt to burn. (b) the placing or distributing of any flammable, explosive or combustible

material or substance, or a device in any building or property with intent to eventually, willfully, and maliciously set fire to or burn, or to procure the setting fire to or burning of the property, shall, for the purpose of this act constitute an attempt to burn such property or building.

Burning to Defraud Insurer

Any person who willfully and with intent to injure or defraud the insurer sets fire to, etc., which shall at the time be insured by any person, company or corporation against loss or damage by fire, shall be guilty of a felony and upon conviction thereof, be sentenced to the penitentiary for not less than one year nor more than five years.[7]

CRIMINAL MISCHIEF

Under the Model Arson Law, a person who purposely, recklessly or negligently employs fire or explosives and damages or destroys another's property, is guilty of arson. This statute has been adopted by many state penal codes with degrees of criminal mischief listed depending upon dollar value of damaged or destroyed property.

Much has been written about the sociological and scientific detection of arson over the past three decades due to increases in life and property losses attributed to fire. In the 1960's, the American Law Institute upgraded the Model Arson Law by nationally standardizing all penal codes and punishments. Most states abide by these proposals.[8]

AMENDMENTS TO THE ARSON LAW

Since the Model Arson Law did not satisfy some states' legal requirements, lawmakers with severe arson problems demanded harsher punishments with longer jail terms. Farmers, who avoided tearing-down costs by burning down their

old buildings, demanded arson code provisions be made to exempt them from arson charges. As a result, many states -- including New York -- made major arson penal code revisions.[9]

The New York State Legislature, on June 13, 1979, passed a penal law ammendment (effective on September 1, 1979) calling for the inclusion of motor vehicles under the arson definition. The amendment stated for arson to have occured:

1. There must have been a fire or explosion.
2. The offence must have occured in a building or a motor vehicle.
3. Intent must be shown.[10]

New York State's revised Arson Law is one of the nation's strictest with its four degrees of arson and attempted arson. Defined as follows they are:

New York State Arson Law, Article 150 of Penal Law[11]

150.00 Arson: Definitions

As used in this article.

1. "Building", in addition to its ordinary meaning, includes any structure, vehicle or watercraft used for overnight lodging of persons, or used by persons for carrying on business therein. Where a building consists of two or more units separately secured or occupied, each unit shall be deemed a separate building.

2. "Motor Vehicle" includes every vehicle operated or driven upon a public highway which is propelled by power other than muscular power, except (a) electrically-driven invalid chairs being operated or driven by an invalid, (b) vehicles which run only upon rails or tracks, and (c) snowmobiles.

150.05 Arson in the fourth degree (class E felony).

1. A person is guilty of arson in the fourth degree when he recklessly damages a building or motor vehicle by intentionally starting a fire or causing an explosion.

2. In any protection under this section, it is an affirmative defense that no person other than the defendant had a possessory or proprietary interest in the building or motor vehicle.

Maximum penalty -- 4 years imprisonment.

150.10 Arson in the third degreee (class C felony).

1. A person is guilty of arson in the third degree when he intentionally damages a building or motor vehicle by starting a fire or causing an explosion.

Maximum penalty -- 15 years imprisonment.

150.15 Arson in the second degree (class B felony).

A person is guilty of arson in the second degree when he intentionally damages a building or motor vehicle by starting a fire, and when (a) another person who is not a participant in the crime is present in such building or motor vehicle at the time, and (b) the defendant knows that fact or the circumstances are such as to render the presence of such a person therein a reasonable possibility.

Maximum penalty -- 25 years imprisonment.

150.20 Arson in the first degree (A-1 felony).

A person is guilty of arson in the first degree when he intentionally damages a building or a motor vehicle by causing an explosion, and when (a) another person who is not a participant in the crime is present in such building or motor vehicle at the time, and (b) the defendant knows

> that fact or the circumstances are such as to render the presence of such a person therein a reasonable possibility.
>
> Maximum penalty -- life imprisonment.

Under the New York State Penal Code the articles dealing with Criminal Mischief are also of interest to the fire investigators just as they are under the Model Arson Law.

> 145.12 Criminal Mischief in the first degree (class B felony).[12]
>
> A person is guilty of criminal mischief in the first degree when with intent to damage property of another person, and having no right to do so nor any reasonable ground to believe that he has such right, he damages the property of another person by means of an explosion.
>
> Maximum penalty -- 25 years imprisonment.

Other states, with similar arson problems, followed New York's lead by revising arson laws to include motor vehicles.

THE INVESTIGATION

Fire investigation's primary objective is to determine the fire's cause through systematic and detailed inquiries. Accidental fire, involving human error, is defined as one that occurs through carelessness or an unforseen event. An incendiary fire, on the other hand, involves the willful destruction of property. Problems of ambiguities existing within the law can compound investigators' problems. The chronological sequence of events must be determined before fire investigators can find the fire's cause. To do this, they reconstruct the incident through a physical examination of the fire scene and interviews with those who might have information on the fire's cause and origin.[13]

> It is interesting to note that this examination is in many ways similar to an autopsy performed by the medical examiner, who seeks to determine the cause of a death. Both the medical examiner and the fire investigator must perform an in-depth, detailed physical examination. Each looks for some point at which the "problem" might have originated. The evidence must be closely scrutinized, photographed, and submitted for laboratory analysis. These processes are forensic in nature. The results obtained will ultimately decide whether a crime was committed, and if a criminal investigation should ensue.[14]

Determining the point of origin may be the investigation's most important fact.[15] Physical evidence of criminal intent is most likely to be discovered in this area of investigation. To discover the fire's point of origin, investigators first examine the building's exterior. Later while examining the interior, they trace the path of burning by following the area of least charring to the area of greatest char and destruction. Because fire burns up and away from the point of origin, low burns are sought and systematically examined.

> The probable point of origin is the pace where the small checks in the "alligator pattern" and the deep charring are found. Thus as the investigator draws closer to the point of origin, he will find that the charring becomes deeper and the segments of "alligatoring" become smaller. The relative depth of charring can be determined with the aid of a metal probe such as an ice pick.[16]

Point of origin examination determines the fire's relative temperature. A hot fast burning fire -- the type produced when an accelerant is used -- leaves a different "alligator pattern" than a normal fire. The char's depth helps to determine the fire's burning time. Next step: find the fire's cause.

> This is accomplished by scrutinizing the evidence that has been gathered, and by assimilating and assessing the data. Specifically, what the investigator attempts to determine at the point of origin is threefold: the initial fuel used; the ignition source; and the event which brings them together. Many times the initial fuel, and perhaps the ignition source will have been moved by the firefighters during the extinguishing or overhauling process. The investigator must, therefore, reconstruct the scene in order to correctly evaluate the evidence. When this has been accomplished the investigator analyzes and assesses all information gathered, then engages in a process of deductive reasoning to establish the probable cause of the conflagration.[17]

While making deductions, investigators give special attention to evidence of a liquid accelerant presence. Gasoline, kerosene, or turpentine are most frequently used by arsonists. Experienced fire investigators can often detect an accelerant's use by the wood's char pattern and the puddle effect on the floor. Because fluid flows downward, the search for traces of an accelerant extends to the lower level and the flooring's underside. When found, accelerant evidence is collected, sealed in an air tight container, and sent to a laboratory for analysis. Investigators may, on this evidence, determine that the fire was incendiary. In "... making this determination, however, the investigator should have eliminated all possible accidental caused fires. ...Interviews may reveal tenable explanations for attendant circumstances"[18] that could make a fire otherwise look suspicious.

Physical evidence gathering is the investigation's initial phase. The first mission: to establish the corpus delicti. Next, investigators search for the modus operandi and added evidence to help establish the perpetrator's

identity. Careful questioning of the person who discovered the fire, the firefighters, the building's occupant and its owner, along with anyone else with information regarding the burned building or premises can also provide needed evidence.

Prior to leaving the scene, investigators sketch and/or photograph the structure, the fire damage and the physical evidence before it is packaged and forwarded to the laboratory. This step is vital, since evidence might be disturbed or destroyed once the investigator leaves the scene. According to recent Supreme Court rulings, without proof of a crime, local courts can refuse to issue search warrants for a return to the fire scene to uncover additional evidence. Fire investigators now check a variety of sources while searching for motive and suspect(s). With sufficient evidence, a suspect can be brought before the court for a hearing and indictment.[19]

Investigators' arrest powers vary with local arrest laws. (Investigators, of course, possess the normal citizen's arrest power at any time.) They may make an arrest for a felony or breach of peace committed in their presence or a felony not committed in their presence if: (1) a felony was in fact committed and, (2) reasonable grounds exist to suspect the person arrested. Under these circumstances, the arresting investigator first obtains an arrest warrant from the court.[20]

Many jurisdictions assign fire investigators "peace officer" or "police officer" status as a means of increasing arrest powers. Other jurisdictions either assign a police officer to work with the fire investigator or assign the police to conduct the entire fire investigation once called to the scene by the fire chief. The choice of a fire's investigative arrangement and its organizational structure varies and has been the cause of countless controversies over the years.

In short, professional fire investigation is a highly sophisticated science requiring both technical and investigative skills -- whether the police or fire department has jurisdiction. An effective, experienced investigator establishes:

1. The fire's origin
2. The fire's cause
3. Its approximate time of ignition

Because fire can alter physical evidence, the professional investigator spends much time and meticulous attention on minute details. For all these reasons, many professionals cite arson as the most difficult of all crimes to investigate.[21]

FOOTNOTES

[1] Martin Scott, "Detection and Investigation of Arson," WNYF, Autumn 1968, New York City Fire Department, N.Y., p. 12.

[2] John R. Carroll, Physical and Technical Aspects of Fire and Arson Investigation, (Springfield, Ill.: Charles C. Thomas, 1979), p. 18.

[3] Richard Ku, Theodore M. Hammett, Giannina P. Rikoski, Debra Day Emerson, Gregory Kennington, Alfred Lima, "Arson Control: A Synthesis of Issues and Strategies Based on the Arson Control Assistance Program", (Cambridge, Mass.: Abt Associates, Inc., November 30, 1981), p. 29.

[4] Common Law.

[5] Charles E. O'Hara, Fundamentals of Criminal Investigation, (Springfield, Ill.: Charles C. Thomas, 1979), p. 239.

[6] John D. DeHaan, Kirk's Fire Investigation, (New York: J. Wiley and Sons, 1983), pp. 333 and 334.

[7] Harvey M. French, The Anatomy of Arson, (New York: Arco Publishing, 1979), p. 9.

[8] Donna L. Rosenbauer, Introduction to Fire Protection Law, (Boston: National Fire Protection Association, 1978), pp. 267-268.

[9] Interview with John Regan, Chief Fire Marshal New York City, New York, 26 November 1987.

[10] Edward J. Shea, "Vehicle Fires" WNYF, 4th Issue 1981, New York City Fire Department, N.Y., p. 16.

[11] New York Penal Law (Revised 1979) Section 150.

[12] New York Penal Law (Revised 1979) Section 145.

[13] Angelo L. Pisani, Jr., "Fire Marshal... A Multifaceted Profession", WNYF, 4th Issue 1981, New York City Fire Department, N.Y., p. 20.

[14] Ibid, p. 21.

[15] Ibid.

[16] Charles E. O'Hara, Fundamentals of Criminal Investigation, p. 225.

[17] Pisani, "Fire Marshal... A Multifaceted Profession" WNYF, p. 21.

[18] Ibid.

[19] Charles E. O'Hara, Fundamentals of Criminal Investigation, p. 259.

[20] Ibid., p. 873.

[21] Harry M. French, The Anatomy of Arson, (New York: Arco Publishing, 1979), p. iii.

CHAPTER THREE

ORGANIZING AND OPERATING AN ARSON CONTROL UNIT

An effective arson control effort requires an operational component (the arson unit) responsible for arson prevention, control and investigative activities. There are four main types of arson unit organizations: the all police unit, the all fire unit, and two versions of the team concept comprised of members from both departments under the administrative control of one or the other department.

Which agency, police or fire, should investigate arson? The answer often traces back to a matter of politics rather than efficiency. In some jurisdictions, the decision was made decades ago and is embedded in the city charter. In others, specifically many of the newer sun belt cities, modern training and technology play important roles in the selection process of the agency.

Since the arson unit operation draws on technical capabilities of firefighters and police, key issues in establishing responsibility -- including degree and nature of police and fire department involvement -- must be examined. We must also explore internal concerns involving the unit's organizational placement, its size, function and responsibility, personnel recruitment, and training.[1]

In one sense, arson is obviously the fire department's concern because it involves fire. But it is also law enforcement's concern because it involves a crime that must be investigated. Not surprising, responsibility for arson investigation has often caused debate and bitterness between the fire and police departments.[2]

> Many believe that the fire department should be solely responsible for arson cases because its personnel are more experienced in determining the causes of fires and are more committed to apprehending arson offenders. In addition, exclusive fire department responsibility for arson can ensure that investigators have at least a basic familiarity with forensic aspects of the fire investigation and that lines of communication and authority during the investigation are simple and direct.[3]

The Abt Associates arson prevention and control study found that many of the cities covered in the study placed responsibility for arson investigation exclusively with the fire department -- a recent innovation for a number of cities. In the past, fire departments relied on police cooperation in arson investigations, but working relationship problems and jurisdictional disputes impaired cooperative efforts. Officials finally concluded that direct control and clear lines of authority within the fire department were more important than the use of police expertise and extra manpower.[4]

The cities using the all fire department approach give police and basic arson training to firefighters assigned to arson investigation. Access to police laboratories, forensic equipment, and records are available for fire investigators. All cities in the Abt study reported all arson cases entailing major felonies (bombings or homicide) automatically involve the police.

Although new to many cities, the all fire department approach has been in effect in New York since the mid-nineteenth century. According to Chief of Staff William Manny's 1980 article, the Division of Fire Investigation was formed in 1854 when the city council gave the fire commissioner permission to hire a civilian employee to investigate and determine causes of all city fires.[5] If the

fire investigator determined the fire suspicious or incendiary, he/she continued the investigation in an effort to find and arrest the perpetrator. Called Fire Marshal, the investigator also carried peace officer status and was armed.

To facilitate the job and avoid political interference, the Fire Marshal answered only to the Fire Commissioner. The New York Fire Marshal's office grew along with the city and by 1950, firefighters with college educations or special police experience, were assigned to help with the increasing office workload.[6]

Still basically a civilian operation in 1950, the Fire Marshal's Office was advanced from The Division of Fire Investigation to a full bureau within the fire department.[7] Bureau members continued to work in civilian clothes, drew up their own budgets and reported directly to the Fire Commissioner. However, the creation of a full bureau emphasized the importance of fire investigation and the New York City Fire Department's involvement in fire investigation.[8]

The bureau's administrative makeup consisted of:

1. A chief fire marshal, appointed by the fire commissioner from the ranks of the supervisory fire marshals.

2. Two deputy chief fire marshals who divided administrative control of the bureau with each deputy responsible for all fire investigation in his or her half of the city. The deputy chief fire marshals were generally selected from civilian fire marshal ranks by the fire commissioner on the advice of the chief fire marshal.

3. Six supervisory marshals, who took turns supervising the night shift and handled all major investigations during day tours, were appointed by the chief fire marshal from the ranks of civilian marshals.

4. Civilian fire marshals were civil service workers, usually ex-insurance investigators who passed a competitive examination for the job. Civilian manpower alloted to the

Bureau of Fire Investigation, including supervisors, never exceeded twelve.

5. Uniformed fire marshals were uniformed firefighters who, because of their education or special training, were assigned to the Bureau of Fire Investigation as acting fire marshals. As many as forty acting fire marshals were assigned to the Bureau of Fire Investigation with the same work schedule and powers as the civilian fire marshals.[9]

As the Bureau of Fire Investigation's workload increased, additional uniformed firefighters were assigned to the office. By 1960, the Bureau had fifty firefighters working as fire investigators. Because new inspectors came from diverse backgrounds, training and education, a formal training program was created. The bureau's new members were assigned to the fire department's Division of Training for a two week training course conducted by supervising fire marshals.

The new marshals were also lectured on police arrest procedures at police academy classes. Small arms training by the F.B.I., initially conducted at the New York City police department's firing range, was later moved to Camp Smith in upstate New York.

Upon completing formal classroom training, the new marshals were assigned to a senior investigator for additional on-the-job training. The novice marshals could expect senior status advancement -- with a new marshal assigned to them -- only after a few years and hundreds of fire investigations.[10]

Though the new administrative makeup proved workable, problems developed. Pay and benefits of the civilian marshals did not keep pace with uniformed marshals' salaries. And, uniformed marshals felt discriminated against because new civilian supervisors were appointed. The problem was resolved in 1973 when civilian marshals were incorporated as fire marshals into the uniformed ranks, with appropriate pay

and benefits. Shortly thereafter, the city developed a mandatory civil service examination for all uniformed members of the fire department aspiring to become permanent fire marshals. Civil service rank and a ten percent increase in salary accompanied the change. All future assignments to the Fire Marshal's office would be promotions made on a competitive basis.[11]

THE ALL POLICE APPROACH

Chicago is the largest city to give full arson investigation responsibility to the police department. It views arson as a crime requiring police expertise and clear lines of command rather than the skills found in the fire department.[12]

Most cities are not enthused about the all-police approach, citing these factors:

1. Police officers generally do not have sufficient arson investigation experience and training.

2. Police investigators are reluctant to do the necessary digging and moving required at fire scene investigations.

3. Because arson investigation is only one of many competing demands made on police time, it frequently gets lower priority than other crimes.[13]

Yet in Chicago, an exception to the general trend, it works. When Edward M. Nickels became a commander of the Chicago Bomb and Arson Squad in 1979, he made a commitment to bring all the resources of his department to the front in the war on arson. According to Commander Nickels, Chicago police respond to all fire incidents and conduct a preliminary investigation with the assistance of the fire chief at the scene. Nickels believes this response by the police department has led to more arson cases being detected and helped the police make more arrests.[14]

> Patrol officers of the Chicago Police are required to conduct preliminary investigations of all fire/explosion incidents and report on those found bonafide. As part of their investigation, the officers are required to consult with the ranking fire officer on the scene for his evaluation of the cause and origin of the fire or explosion. Such consultation, in addition with other information gathered by officers through their observation and interviews of witnesses or bystanders, is the basis for data reported by them. When circumstances indicate a fire or explosion was purposely set, an arson investigation is immediately initiated.[15]

Chicago, like New York, houses all its arson investigators within one department, and, therefore, does encounter administrative problems anticipated in the joint administrative approach. Commander Nickels handled his investigators' lack of fire experience by selecting only experienced police detectives -- generally with bomb squad experience -- and giving them a two-week course at the National Fire Academy. In order to insure coverage of all reported suspicious and incendiary fires, the unit was expanded from fourteen to twenty-four men. According to Commander Nickels, the unit proved its ability in a number of arson fires investigated and arrests made.

THE JOINT FIRE AND POLICE APPROACH

Despite numerous arguments, few jurisdictions questioned in the Abt study chose to vest full responsibility for arson investigation solely in either the police or fire departments. Most jurisdictions recognized the police and fire departments have their own specialized skills and expertise. Thus, the most common approach to arson investigation is a form of divided or shared responsibility between the two departments. (The Abt Associates developed a

typology of organizational approaches to arson investigation.[16])

Typically, the fire department makes cause and origin determination and interviews witnesses and occupants.

> If there is reason to believe that the fire is arson, the case is turned over to the police department. This may not even be recognized as a division of responsibility with respect to arson investigation, but simply as the routine performance of activities in the two departments....
>
> Where there is a well-developed fire investigative function within the fire department, the division of responsibility may be different, with the fire department conducting some of the follow-up to the scene investigation. Regardless of the exact division of responsibility, the salient characteristic of the organization is that the two sets of investigators belong to different departments, report to different supervisors, and keep separate records.[17]

NEW ORLEANS EXPERIENCE

In 1981, New Orleans was credited with having one of the country's most effective local arson task forces by the United States Fire Department (in a report submitted to Carroll Herring, State Fire Marshal of Louisiana by the coordinator of the City of New Orleans.) However, prior to the task force's formation, responsibility for arson investigation was vested in the fire prevention division of the fire department which employed two untrained investigators.[18] When the fire department responded to a fire, the chief in charge of the scene determined the fire accidental or incendiary. If arson was suspected, an investigator from the fire prevention division conducted an investigation. In 1987, only four arson cases were accepted for prosecution, three of which resulted in plea bargains with jail time for those found guilty.[19]

With the development of the task force in 1980, the arson squad assumed a specialized function. Still located in the fire prevention division, the arson squad now had four investigators assigned to work expressly on arson investigations. The police department also assigned four members to the task force. All were sent to the National Fire Academy for arson determination courses. The duty roster of the fire investigators has been changed to coincide with that of the police investigators.[20]

When a suspicious fire is reported, a fire department investigator determines whether or not it is arson. If an arson determination is made, a police investigator is called. Thereafter, the two investigators work as a team until the investigation is completed.[21]

Several problems emerged despite the apparent successful operation of the task force. At combined department meetings, the fire department accused police investigators of not always being available. The police complained that they were not being notified of all suspicious fires. Reports showed fire chiefs leaving the fire scene before arson investigators arrived. In an effort to resolve these problems, it was agreed that the task force would meet weekly and that the district attorney's representative should be present at the meetings.[22]

> In the meeting of the Arson Squad, further problems were discovered. Apparently, the police investigators were often not available for arson cases because of a conflicting workload, the police investigators needed more automobiles and pagers, and the records for the entire squad needed to be centralized. The Police and Fire Chiefs met and assigned a management team of the supervisory personnel of the fire and police squads and the chairman of the subcommittee on Coordination of System Efforts to develop solutions. Within a month police investigators were placed into an Arson and

> Bomb Squad under a sergeant who provided some of the necessary direct supervision. ...The fire and police investigators also formed teams of two riding in the same car. The management level meetings further refined notification of fires and designed a standard incident report form for the Fire Department that complemented the Police Department's report forms. Although records and operations have not been centralized, squad meetings have been held alternately at either Fire Headquarters or at the Police Arson and Bomb Squad Offices.[23]

As team efficiency improved with experience, investigators began spending more time as expert witnesses in civil court. Their testimony most often supported insurance companies not paying claims. In this role, fire investigators learned from the more experienced police investigators. Currently, Arson Squad members are revising the standard report form to include needed trial information. Police investigators learned much from fire investigators about arson detection and on-the-scene investigation. Conversely, police investigators teach fire investigators witness interrogation techniques, stake-out know-how, and report completion.[24]

In concluding its report on New Orleans, the U.S. Fire Administration stated:

> The City of New Orleans has been served well by its Arson Task Force. The Arson Task Force has increased the City's capacities for arson prevention and control and has documented well its activities. In comparison to where the City's anti-arson programs were in 1979 to the progress made to date there exists no questions of the Arson Task Force's effectiveness. The ability of the Arson Task Force to stimulate support and leverage resources for its programs is a tribute to the level of commitment of those involved. The New Orleans Arson Task Force is a model of a local commitment to effectively combat

arson that other communities could profit by following.[25]

Small and medium sized cities throughout the United States, experiencing increases in suspicious and incendiary fires, have made efforts to establish arson squads or task forces. Each city made those changes possible within budget and political restraints.

SEATTLE EXPERIENCE

Seattle's escalating arson-related property losses increased from six hundred twenty one thousand dollars in 1971 to three million two hundred thousand dollars in 1974.[26] Spurred by these losses, the mayor created an Arson Task Force calling for combined fire and police support. Meetings and conferences were held among the mayor's office, the police and fire departments, the city council, county prosecutor's office, chamber of commerce and the Washington Insurance Council.[27]

As a result of these meetings, the fire department's arson investigative unit was placed under the fire chief's direct supervision. In addition, to match resources with responsibility, operations control remained with the chief. Two police detectives wre transferred to the fire department's arson unit under the operational control of the fire chief, but remained under the police chief's administrative control. All twenty-eight fire investigators were required to attend a two hundred and eighty-six hour intensive training program.

Seattle's results have been dramatic. Annual losses from suspicious and incendiary fires dropped from three million two hundred thousand dollars in 1974, to two million six hundred thousand dollars in 1975, to one million nine hundred thousand dollars in 1976. As dollar losses declined, arson apprehensions rose: Authorities reported arrests in twenty-two percent of reported arson cases in 1975, thirty-

nine percent in 1976 and over sixty-five percent in the first half of 1977.[28]

Other U.S. cities with fewer resources but the same need to slow down or offset arson's destructive effects began trying new investigative approaches.

NEW HAVEN EXPERIENCE

In Connecticut, New Haven -- typical of many smaller older communities -- reported suspicious and incendiary fires increased more than four hundred percent from 1973 to 1976. A grand jury report, by Judge Irving Levine, informed city officials of the growing arson problem involving major tax roll losses.[29]

In The Fire and Arson Investigator, Frank Logue of New Haven stated:

> After reading the Grand Jury report, I met with the Fire Chief, who confirmed that New Haven lacked the capacity to conduct proper investigations of suspicious fires. We clearly needed to develop a close and cooperative daily working relationship between the police and fire departments in arson investigation, a relationship that did not exist at that time. Since the Mayor of New Haven appoints both the fire chief and police chief, he is thus in a good position to foster such cooperation.[30]

Less than a month after receiving the report from Judge Levine, Mayor Logue established an advisory Arson Task Force. Its members included persons from the mayor's office, the fire and police departments, and the consulting firm Abt Associates. The advisory Arson Task Force's first recommendation: create a joint police/fire arson team. This combined unit assumed a responsibility that never before existed in New Haven. Four trained investigators (two detectives and two firemen from the Fire Marshal's office) joined the new Arson Squad. Squad members trained at the

National Fire Academy and attended the State's Attorney's criminal investigation program.[31]

Which type investigative organization -- police, fire, or joint team -- proved most effective in arrests per arson investigations performed? One hundred and fifty-five jurisdictions were analyzed using various dependent and intermediate variables.

FOOTNOTES

[1] Abt Associates, Arson Prevention and Control: Program Model. (Washington, D.C., U.S. Department of Justice, January, 1980), p. 37.

[2] Ibid.

[3] Ibid., p. 38.

[4] Ibid.

[5] William F. Manny, Jr., "Division of Fire Investigation," WNYF 3rd Issue, 1980, p. 10.

[6] Interview with Vincent Canty, Chief Fire Marshal of New York City, New York, N.Y., 1 September 1974.

[7] Ibid.

[8] Interview with Donald Pisculli, Supervising Fire Marshal, New York City, New York, N.Y., 15 October 1980.

[9] Ibid.

[10] Interview with John Regan, Chief Fire Marshal, New York City, New York, N.Y., 15 November 1987.

[11] Ibid.

[12] Abt Associates, Arson Prevention and Control: Program Model. (Washington, D.C., U.S. Department of Justice, January, 1980), p. 38.

[13] Ibid., p. 39.

[14] Interview wih Edward Nickels, Commander Bomb and Arson Squad, Chicago, Ill., Glecoe, GA, 20 July 1982.

[15] Department of Insurance, Fighting Arson: An Update on Illinois' Cooperative Effort, (Chicago, Ill., 1982), pp. 34-35.

[16] Richard Ku, Theodore M. Hammett, Debra Day Emerson et al., Arson Control: A Synthesis of Issues and Strategies

Based on Arson Control and Assistance Programs, (Washington, D.C., U.S. Department of Justice, November, 1981), p. 10.

[17] Ibid, pp. 8-9.

[18] Frank R. Serpas, Jr., Director Criminal Justice Coordinating Council, Report to Carroll Herring, State Fire Marshal of Louisiana, 28 October 1981, p. 4.

[19] Ibid., pp. 4-5.

[20] Ibid.

[21] Ibid., pp. 5-6.

[22] Ibid., p. 9.

[23] Ibid., p. 10.

[24] Ibid., pp. 11-12.

[25] John W. Lynch, Director, Arson Assistance Programs, U.S. Fire Adminisration, Report to William J. McCrossen, Superintendent of Fire, New Orleans Fire Department, July 8, 1981, p. 62.

[26] "The Seattle Approach," Backgrounder, (Hartford Conn., Aetna Life and Casualty, 1980), pp. 1-2.

[27] Ibid.

[28] Ibid., p. 1-5.

[29] Ibid.

[30] Frank Logue, "A Municipal Anti-Arson Strategy: The New Haven Model," The Fire and Arson Investigator, Volume 30, Number 4, April-June, 1980, p. 30.

[31] Ibid., p. 31.

CHAPTER FOUR

METHODOLOGY

Because jurisdictions use different approaches and agencies in conducting arson investigations, a wide difference in background, training, efficiency, and importance placed on an investigation in relation to other duties exists.

This study, covering the years 1970-1975 examines and compiles data for one hundred and fifty-five jurisdictions. It compares data on population served, number of fires in each jurisdiction, number of fires declared suspicious or incendiary, number of fires investigated, number of arson arrests, types of investigative approaches, number of investigators per unit, budget and training.

It analyzes other variables to account for social problems that might be encountered in a jurisdiction. These variables include: per mile population density, percent of single family dwellings, percent of multiple dwellings with five or more units, 1970-1975 population change, percent of blacks and females, average per capita income, median family income, median black family income (See Appendix B).

Data on time spent per case was not available. However, it might be determined from the unit's case load and available resources.

A United States Department of Justice study -- A Survey of Arson and Arson Response Capacities in Selected Jurisdictions -- analyzed the number of fires investigated per investigator. It found in forty-three percent of cities with over 500,000 population, arson units investigated over one hundred twenty fires per investigator per year. The

other fifty-seven percent investigated less than eighty-five fires per year per investigator.[1]

The Justice survey also reported the median number of investigations in the cities with the higher workload, was one hundred and fifty-three and arrests averaged twelve and nine-tenths. For cities with the lower workload, the median number of investigations was sixty-two and arrests averaged eight and eight-tenths. Therefore, a workload level one hundred fifty percent higher yielded an average arrest rate forty-seven percent higher.[2] (See Chart A).

Urban decay was also evaluated in the Justice survey as an arson rate factor. Correlation coefficients were tested for (1) residential housing vacancy rates, (2) population per square mile, (3) change in the number of manufacturing establishments, (4) population change 1960-1970 , and (5) population change 1970-1975. High population density and a decline in the number of manufacturing establishments, the study found, correlated with the number of fires. However, when multiple regression analysis was used, these factors did not explain any more of the variation than the simple population change from 1970 to 1975.[3]

The purpose of this new study is to try to determine, by using available data from previous studies, if there is a difference in the efficiency of one type of investigative unit over another. Justice Department study findings were used to select jurisdictions for the new study. According to the Justice Department, the average rate for all cities sampled was 98.2 per 100,000 with virtually no difference between the size of the city and the arson rate (cities of more than 500,000 had an average rate of 96.4 per 100,000, cities of 50,000 to 80,000 had a rate of 100.5).[4]

Many other factors besides population size -- including age distribution, racial composition of the population, density of population, presence of organized crime -- may affect United States' arson rates. The jurisdiction's

economic conditions might also have a significant effect. Another very important factor affecting arson rate is population decline where it exists. The Justice study found "cities with declining populations have substantially more fires in buildings and arson fires per capita than those with stable populations."[5] The smaller the population percentage loss, the less effect on the arson problem.

A study by Akeyama and Pfeiffer, Arson: A Statistical Profile, found that arson arrest rates for non-whites versus whites has remained constant since 1965, (two to one). It also reported one-fourth of all 1983 arson arrests involved persons under fifteen years of age and over sixty percent were persons under twenty-five. Arson, it found, is predominantly a young, white, male phenomenon.[6]

Concern over the possibility that a jurisdiction might exaggerate its clearance rates by charging a suspect with as many arson fires as possible prompted an examination of the results of the Abt Associates study. Titled Arson Investigation and Prosecution: A Study of Four American Cities, it traced arson incidents, rather than arrests, so that its data does not reflect rates of arson case clearance by arrest. However, it found that the rates of case presentation were similar to the Uniform Crime Report figures on arrest rates. According to the Abt study, arson can be a crime of assault, violence and death. Yet, it concludes that cases of arson are cleared at a far lower rate than other crimes of violence.

Clearance rates for arson are much closer to those of property crimes. The Abt Associates believe the difference lies in the character and quality of the available testimonial evidence. Crimes of violence generally involve personal contact, while arson, like other property crimes, generally do not. As a result, direct testimonial evidence linking the perpetrator to the crime is rare. The Abt study found "once an arson case is developed and accepted for

prosecution, it stands about the same chance of resulting in conviction as does any other felony case."[7]

In this new study, a review of the one hundred and fifty-five cities shows four cities use the all police department approach, fifty-four use the all fire approach, and ninety-six use the team approach. In team cities, sixty-six house the administrative control in the police department and thirty house administrative control in the fire department. Surprisingly, one city was not sure who had administrative control over arson cases.

In assessing the effectiveness of different approaches to arson investigation examined in this study, several different dependent variables (DV's) are considered in an attempt to unearth so-called "process variables" in the organizational structure. The DV's include fires declared (a) not accidental, (b) suspicious, (c) incendiary, (d) fires investigated along with the number of (e) arson arrests, (f) incendiary fires cleared by arrest, and (g) arson fatalities. The first three of these may seem to be independent variables, (IV's) but, in fact, they are under the tight control of organizational structure and will be treated as DV's, that is, as effects, not causes. No attempt has been made to make systematic observations of some jurisdictions' failures to detect arson, although misclassification of some fires as accidental was common. The large volume of fires in this study provides balance for the data.

Investigative units, faced with the need to operate with limited resources, must set investigative priorities. In some investigations, a case may be solved almost immediately. In others, unlimited efforts can prove futile leaving the case unsolved. Therefore, investigative case management practices require that priorities be established to help decide which cases need additional efforts. These decision making practices are reviewed with the different investigative structures.[8]

The more go/no-go decision making levels in arson case administration, the more opportunity for cases to be sidetracked or remain unsolved. Better communication and easier monitoring offered by an all-fire approach, an all-police approach or the fire/police team involving one administrative unit are preferable to divided responsibilities.[9] These organizational structures and decision making levels are considered intervening variables.

The dependent variables (DV's) were listed as:

1.	fires declared not accidental	Table # 1
2.	fires declared suspicious	Table # 2
3.	fires declared incendiary	Table # 3
4.	fires investigated	Table # 4
5.	number of arson arrests	Table # 5
6.	number of incendiary fires cleared by arrests	Table # 6
7.	number of arson fatalities	Table # 7

All of these variables are dimensions of arson investigation effectiveness.

Various socio-economic variables were treated as extraneous variables (EV's) and these included:

1.	population	Table # 8
2.	single family units per dwelling	Table # 9
3.	five or more family units per dwelling	Table #10
4.	population density per mile	Table #11
5.	percent of population change from 1970 to 1975	Table #12
6.	percent of black population	Table #13
7.	per capita income	Table #14
8.	median family income	Table #15
9.	median black family income	Table #16
10.	percent Hispanic population	Table #17

The initial computer run listed the mean, median and the standard deviation of the dependent and the extraneous variables.

TABLES OF DEPENDENT VARIABLES (DV's)

Table #1 FIRES CLASSIFIED AS NOT ACCIDENTAL

Moments		Quartiles	
Number	91	100% max.	13,178
Mean	522.341	75% Q3	432
Std. Deviation	1485	50% med.	183
Skewness	7.37309	25% Q1	89

Table #2 INCENDIARY AND SUSPICIOUS FIRES

Moments		Quartiles	
Number	123	100% max.	8,810
Mean	299.098	75% Q3	277
Std. Deviation	842.329	50% med.	100
Skewness	8.75508	25% Q1	52

Table #3 INCENDIARY FIRES

Moments		Quartiles	
Number	114	100% max.	4,576
Mean	228,982	75% Q3	214.5
Std. Deviation	817.548	50% med.	80
Skewness	6.21996	25% Q1	36.75

Table #4 FIRES THAT WERE INVESTIGATED

Moments		Quartiles	
Number	121	100% max.	5,427
Mean	499.769	75% Q3	481
Std. Deviation	817.548	50% med.	189
Skewness	4.02527	25% Q1	63

Table #5 INDIVIDUAL ARSON ARRESTS FOR ARSON FIRES

Moments		Quartiles	
Number	116	100% max.	487
Mean	49.7759	75% Q3	43.75
Std. Deviation	90.232	50% med.	16.5
Skewness	2.96541	25% Q1	5

Table #6* INDIVIDUAL ARSON ARRESTS FOR SUSPICIOUS FIRES

Moments		Quartiles	
Number	116	100% max.	487
Mean	49.7759	75% Q3	43.75
Std. Deviation	90.232	50% med.	16.5
Skewness	2.96541	25% Q1	5

*Tables 5 and 6 are similar due to suspicious fires being reclassified as arson fires as soon as an arrest is made.

Table #7 DEATHS CAUSED BY ARSON FIRES

Moments		Quartiles	
Number	100	100% max.	42
Mean	2.42	75% Q3	1.75
Std. Deviation	7.025	50% med.	0
Skewness	4.42703	25% Q1	0

TABLES OF EXTRANEOUS VARIABLES (EV's)

Table #8 POPULATION OF THE CITY UNDER STUDY IN THOUSANDS

Moments		Quartiles	
Number	155	100% max.	7428
Mean	313.187	75% Q3	301
Std. Deviation	701.684	50% med.	118
Skewness	7.6386	25% Q1	74

Table #9 PERCENT SINGLE FAMILY DWELLINGS

Moments		Quartiles	
Number	154	100% max.	100
Mean	54.2364	75% Q3	79.475
Std. Deviation	30.0675	50% med.	54.15
Skewness	-0.0746	25% Q1	31.3

Table #10 PERCENT DWELLINGS WITH FIVE PLUS FAMILIES

Moments		Quartiles	
Number	144	100% max.	100
Mean	40.6937	75% Q3	59.425
Std. Deviation	28.741	50% med.	37.95
Skewness	0.376715	25% Q1	18.625

Table #11 POPULATION DENSITY PER MILE

Moments		Quartiles	
Number	154	100% max.	24,964
Mean	5072.99	75% Q3	6,068
Std. Deviation	4178.59	50% med.	3,419.5
Skewness	2.07292	25% Q1	2,593.75

Table #12 POPULATION CHANGE 1970-1975

Moments		Quartiles	
Number	153	100% max.	54.4%
Mean	2.3294	75% Q3	7.2%
Std. Deviation	11.4016	50% med.	-0.1
Skewness	1.66797	25% Q1	-5.8

Table #13 PERCENT BLACK POPULATION

Moments		Quartiles	
Number	146	100% max.	81.4%
Mean	15.5361	75% Q3	25%
Std. Deviation	15.7	50% med.	10.5%
Skewness	1.338727	25% Q1	2.4%

Table #14 PER CAPITA INCOME

Moments		Quartiles	
Number	154	100% max.	8,593
Mean	4805.99	75% Q3	5,133.75
Std. Deviation	806.107	50% med.	4,635.5
Skewness	1.50149	25% Q1	4,321.5

Table #15 MEDIAN FAMILY INCOME

Moments		Quartiles	
Number	154	100% max.	17,031
Mean	9966.12	75% Q3	10,694
Std. Deviation	1925.72	50% med.	9,849
Skewness	-0.08386	25% Q1	

Table #16 MEDIAN BLACK FAMILY INCOME

Moments		Quartiles	
Number	126	100% max.	12,400
Mean	6891.83	75% Q3	7,669.25
Std. Deviation	1509.26	50% med.	6,844.5
Skewness	0.806487	25% Q1	5,927.5

Table #17 PERCENT HISPANIC POPULATION

Moments		Quartiles	
Number	123	100% max.	91.5%
Mean	8.7455	75% Q3	12.3%
Std. Deviation	14.4045	50% med.	2.9%
Skewness	3.48504	25% Q1	1.4%

The true independent variable was "who has the responsibility for the investigation of arson" -- the fire department (FD), the police department (PD), a team of fire and police officers administered by the fire department (FD*/PD), a team of fire and police officers administered by the police department (FD/PD*). These represent aspects of the organizational setting and reflects a strategy of organizational control.

Another category of variables was labeled quasi-independent variables (QVI's) which includes dimensions of the aspects of daily operational tactics or processes. This category differed from one jurisdiction to another and did affect the efficiency of the unit. These QVI's included daily operations tactics such as:

1. budget of the department that houses or administers the arson unit (see Table 18)
2. number of peronnel assigned to the arson unit (see Tables 19A and 19B)
3. use of a data system -- the uses of a data system were identified as (a) identification of similar modus operandi (MO); (b) prediction of vulnerable locations (VL); and (c) no use of data reported (NA)
4. amount of training the arson unit personel received
5. use of arson task force
6. posting of vacant buildings
7. show of force in high arson areas

8. offer of rewards for information on suspected arsonists
9. boarding up of vacant buildings to discourage vandals.

Table #18 BUDGET OF UNIT ADMINISTERING ARSON UNIT IN MILLIONS OF DOLLARS

Moments		Quartiles	
Number	140	100% max.	388
Mean	10.3271	75% Q3	9
Std. Deviation	33.9975	50% med.	4
Skewness	10.1578	25% Q1	2

Table #19A NUMBER OF FD PERSONNEL ASSIGNED TO ARSON UNIT

Moments		Quartiles	
Number	132	100% max.	163
Mean	6.61364	75% Q3	6
Std. Deviation	14.8995	50% med.	4
Skewness	9.15475	25% Q1	3

Table #19B NUMBER OF PD PERSONNEL ASSIGNED TO ARSON UNIT

Moments		Quartiles	
Number	61	100% max.	6
Mean	1.2623	75% Q3	2
Std. Deviation	1.66234	50% med.	1
Skewness	1.38954	25% Q1	0

All the data was prepared for entry into the City University of New York JES3 job stream via WYBUR utility, OUTSERV. Once on line, the data was sent to the Statistical Analysis System (SAS) for further processing.

FOOTNOTES

[1] Theodore M. Hammett, Director Arson Investigation and Prosecution: A Study of Four American Cities, (Washington, D.C., National Institute of Justice, March, 1974), p. 12.

[2] Ibid.

[3] Ibid., p. 3.

[4] Stephen H. Webster, Kenneth E. Mathews, Jr., A Survey of Arson and Arson Response Capabilities in Selected Jurisdictions. (Washington, D.C., U.S. Department of Justice, February 1979), p. 10.

[5] Ibid., p. 1.

[6] Yashio Akeyama, "Arson: A Statistical Profile," pp. 110-112.

[7] Stephen H. Webster, A Survey of Arson and Arson Response Capabilities in Selected Jurisdictions. p. 9.

[8] Theodore M. Hammett, Arson Investigation and Prosecution: A Study of Four American Cities. p. 143.

[9] Ibid.

CHAPTER FIVE

RELATIONSHIP AMONG VARIABLES

DEMOGRAPHIC IMPACT

In stepwise regression, the first set of analyses includes dependent variables on demographic variables with many of the results predictable. In the one hundred and eight cases analyzed involving the jurisdiction's population and the dependent variables of suspicious and incendiary fires, researchers found the population formed a nearly perfect positive linear relationship with the variable and contributed 92.7 percent of the variance.

In selecting variables to help predict the unit or jurisdiction more likely to investigate a fire, the regression results showed: (a) the overall variance of 56.8 percent explained by population, (b) 5.2 percent by percentage of blacks, and (c) 1.1 percent of five or more family units per dwelling. More fires, it would seem, are investigated in highly populated cities (including New York, Los Angeles, Detroit, Houston, Memphis, Newark and Tucson) with a high percentage of black families and a great proportion of multiple dwellings.

Incendiary fires analyses show population as the only contributing variable -- with an overall variance of 82.5 percent.

Three variables helped predict the number of arrests. Overall variance was explained by population (40.7 percent), five or more family units per dwelling (5.6 percent), and number of blacks (2.9 percent). Results show more arrests in highly populated cities with large black populations and a large number of five or more family units per dwelling.

Included among cities with a large number of arson arrests are: New York, Buffalo, St. Paul.

ORGANIZATIONAL SETTING IMPACT

The second set of data analyzed involves the independent variable of investigative responsibility with the same dependent variables already residualized for the respective significant demographic variables. Two findings were of note in this analysis. Both signify similar results.

Analysis of variance was computed with the residualized dependent variable, suspicious and incendiary fires. Results indicate a significant difference in the means for the single unit variable (as oppposed to the team concept), fire department only = 6.94, police department only < .05, and the r^2 = 5.4 percent.

LEADERSHIP	NUMBER	MEAN
Team	77	40.96
Single Unit	46	-68.57

Teams, as opposed to single units, respond to higher incidences of fires labeled "incendiary and suspicious." Possible explanation: once a team is formed, fire chiefs are encouraged to use it whenever possible. And, because of the added investigative ability, chiefs are more willing to consider a fire "suspicious or incendiary."

Results also indicate a significant difference in the means for the fire/police team variable, fire department lead = 7.81, police department lead = < .05, r^2 = 6.0 percent.

If a great difference in effectiveness among the various investigative units does not exist, we must then try to explain the distribution of alternative arrangements.

ADMINISTRATIVE CONTROL	NUMBER	MEAN*
All others	79	41.79
Team Concept: F.D.Lead	44	-75.03

*Number may vary because some jurisdictions did not respond.

Results indicate teams investigate more "suspicious or incendiary" fires than all-police or all-fire units -- especially if teams are led by the fire department.

IMPACT OF OPERATIONAL MODES ON INVESTIGATION EFFECTIVENESS

The third set of analyses involves the regression of operational variables on the effectiveness of investigation variables. A similar pattern of predictor variables was found for all of the dependent variables.

The overall variance of 10.3 percent in predicting incendiary and suspicious fires is composed of two variables: (a) posting of buildings (6.6 percent) and (b) show-of-force (3.7 percent). Analyses show incendiary and suspicious fires are more likely to occur in cities with a higher rate of posted buildings and cities using show-of-force in arson control.

The best model in predicting the dependent variable -- investigated fires -- consists of three variables forming an overall variance of 16.5 percent: (a) show-of-force 8.7 percent, (b) posting 5.6 percent, and (c) task force use 2.2 percent. These results indicate that more fires are investigated in similar type cities having more incendiary and suspicious fires, but with the task force use variable.

Show-of-force (10.9 percent) and posting (6.3 percent) again contribute to an overall variance of 17.2 percent in predicting incendiary fires. This indicates that jurisdictions using show-of-force and postings label more fires as incendiary. But, results do not show if (a) there are actually more incendiary fires, or (b) the jurisdiction is simply more careful in its investigation, or (c) is simply more willing to label a fire as incendiary.

Arson arrests are more likely to occur in cities where a task force is used and buildings are posted. The overall variance (14.6 percent) breaks out by posting (10.5 percent) and task force use (4.1 percent).

High fatality rates occur in similar type cities as those with high arrest rates. Posting contributes 13.3 percent and task force use contributes 3.1 percent to an overall variable variance of 16.4 percent.

IMPACT OF OPERATIONAL MODES ON INVESTIGATIONS' RESIDUALIZED EFFECTIVENESS

The fourth set of analyses involves the regression of operational variables on the dependent variables of investigative outcome already residualized for respective significant demogaphic variables.

Another variable was found when the variables were controlled for demographics. However, a similar pattern of predictor variables was found for all the dependent variables.

The residualized variable -- incendiary and suspicious fire -- had only one contributing variable -- reward -- to the overall variance of 3.8 percent. Cities that offer rewards for information on arsonists and arson fires either (a) discover more suspicious or incendiary fires, or (b) so label recorded fires.

Two variables contributed to the overall variance of 8.2 percent in predicting investigated fires residualized. The overall variance is explained by task force use (4.8 percent) and offering of rewards (3.4 percent). The rate of investigated fires is also higher in cities using both a task force reward for information.

This combination -- reward and task force -- contributes to the prediction of arrests residualized. The variance of 11.2 percent is explained by the use of rewards (6.6 percent) and use of the task force (4.6 percent). Once again, rewards for information help investigators find arsonists and task force use helps the overall arrest rate. This suggests a budget appropriation, to increase citizen involvement, could be useful in arson fighting.

The two earlier variables -- show-of-force and posting -- contribute to the prediction of incendiary fires residualized and incendiary fires not residualized. The overall variance of 11.8 percent breaks out: show-of-force (7.9 percent) and posting (3.9 percent).

Only one variable contributed to the predicting of fatalities residualized -- the posting of buildings (6.6 percent variable). However, this cannot be explained from known information at this time.

Of course, posting and show-of-force are not the causes of fire fatalities. A city with more fire/arson problems may also have more fire fatalities.

Analyses of who does the investigations and most efficient type investigation unit (measured by number of arrests per investigation) are inconclusive. The study, however, indicates fire departments responsible for arson investigation were more involved in training, the use of data systems, a show-of-force, and the offering of rewards. Qualities that make an investigative unit more efficient tend to encourage that unit to investigate more fires labeled "suspicious or incendiary."

Ultimately, what was done proved more important than who did it. (For discussion of policy implications of results, see concluding chapter.)

EXPLAINING THE ORGANIZATIONAL SETTING

The fifth set of analyses involves the stepwise regression of demographic variables on investigative responsibility and operational variables.

The newer sunbelt cities, because they tend toward advanced technology, generally opt for one unit located in the fire department. In older, more densely populated cities, police are generally involved in arson investigation because many of the positions are civil service and

incorporated into union contracts. This makes change difficult for old line municipalities.

Sunbelt city managers, not so restricted, may prefer turning over fire investigations to fire departments presenting themselves as "highly trained scientific experts." However, this is merely conjecture and may not comply with facts.

Two variables -- population (4.1 percent) and population density (4.5 percent) -- contribute to the overall variance of 8.6 percent in predicting the variable FD/PD (fire department vs. no fire department involvement). Results show cities with large populations, but not densely populated, are more likely to have fire department only involvement in arson investigation responsibility.

The best model for predicting investigative structure -- single vs. team concept -- consists of two variables with an overall variance of 8.8 percent: (a) population 4.1 percent and (b) density 4.7 percent. Results indicate cities with large populations, not densely populated, are more likely to have single unit responsibility for arson investigation.

Eighty-five out of the one hundred thirty-five cases analyzed had fire department involvement and fifty-seven used the fire department only approach. Therefore, it seems cities with large non-dense populations are more likely to use the fire department alone. (Chicago is the exception. Here, the police department is responsible for arson investigations.) This profile seems to fit newer sunbelt cities including Los Angeles, Phoenix and Houston.

EXPLAINING THE OPERATIONAL MODES

The best model in predicting the operational variable -- posting of vacant buildings -- consists of two variables with an overall variance of 5.9 percent: population (4.2 percent) and the percentage of five or more family units per dwelling (1.7 percent). (See page 50 for detailed explanation of

QVI's.) Results indicate cities with large populations and large numbers of five or more family units per dwelling have a greater likelihood of posting-up vacant buildings. (Examples: New York, Detroit, Baltimore.)

The best model in prediciting show-of-force consists of three variables. The total variance of 12.3 percent is accounted for by the percentage of blacks (8.2 percent), density (4.3 percent), and population (.9 percent). Cities with large populatiosn, high percentage of blacks, and high density are more likely to use a show-of-force in controlling arson. (Examples: New York, Detroit, Birmingham).

The variable -- reward -- is best predicted by two variables with an overall variance of 2.8 percent: population (.9 percent) and density (1.9 percent). Cities with large, but scattered, populations are more likely to use a system of rewards to help control arson. (Example: Houston.)

The variable -- boarding-up of vacant buildings -- has the best model prediction variance of 3.8 percent. The variable -- population change -- is the only contributing variable. Results show cities with declining populations more likely to board-up vacant buildings.

Older cities, showing declining populations, seem to rely on show-of-force, boarding-up and posting vacant buildings. Larger, less densely populated sunbelt and western cities perfer rewards for arson control. Effects of this are significant but not statistically large.

RELATIONSHIP BETWEEN OPERATIONAL MODE AND ORGANIZATIONAL SETTING

The causal connection between operational modes and organizational setting is tenuous at best, and none of the theory discussed above suggests a relationship. However, the emergence of a relatively large r^2 suggests that the old

city/new city cleavage is a significant explanatory factor. This result tends to validate the above findings.

The best model for predicting cities with fire department involvement consists of three variables with an overall variance of 20 percent: training (13.9 percent), use of a data system (4.3 percent), and show-of-force (1.89 percent). Results indicate cities with high degrees of training, computerized data systems and using show-of-force techniques are more likely to have fire department involvement in fire investigations. (Examples: Detroit, San Francisco, Seattle, Long Beach, Portsmouth, VA; Indianapolis.)

The best model for predicting cities with a single unit as opposed to a team consists of two variables with an overall variance of 11.1 percent: training (8.3 percent) and reward (2.8 percent). Cities with a high degree of training which use rewards are more likely to report a single arson investigation unit as opposed to the team. When a single unit exists, in almost all cases, it is the fire department.

The best model for predicting the interaction of the above two variables -- FD/PD lead -- consists of two variables with an overall variance of 12.4 percent: training (9.4 percent) and reward (3.0 percent). The results, therefore, suggest that cities with training and which use rewards are more likely to have arson investigations led by single units of fire department personnel.

The new city/old city cleavage seems validated by this study's results. Newer, larger cities without dense populations prefer to offer crime control rewards which seem to lead to more arrests when demographics are held constant. These same cities also tend to place the fire department in charge of arson investigation and encourage a show-of-force and rewards for arson control.

Large, densely populated, older cities with declining populations tend to post or board-up buildings and tend

toward a show-of-force in arson control. These administrative actions are responses to the arson problems and not solutions to it.

To determine differences in administrative approaches to the arson problem between newer and older cities with established or declining populations and the northern and sunbelt cities another computer run was necessary.

RELATIONSHIP BETWEEN GROWING CITIES AND THE DEPENDENT VARIABLE (see dependent variables P. 44)

The sunbelt cities and growing cities (appendix C) were added to the computation as new independent variables and subjected to the stepwise regression process with the dependent variables (listed on page 42).

With demographic adjustment, the analysis of the residualized suspicious and incendiary fires show that growing cities experience a mean of 131 (r^2 = .08) fewer incendiary and suspicious fires than do non-growing cities. (Table 20)

Table 20 Suspicious & Incendiary Fires

SUNBELT	Growth: Yes	Growth: No	Mean
Yes →	-80.19	9.71	-60.21
No →	-15.61	77.13	63.22
	-70.71	61.67	

r^2 = .08

All other differences tested were not significant.

RELATIONSHIP BETWEEN GROWING CITIES AND OPERATIONAL MODES

The ninth set of analysis involved the residualized operational variables on the independent variable of population stability.

The .028 overall variance shows growing cities post buildings more frequently than cities not experienceing growth. (Table 21)

Table 21 Residualized Posting of Building

SUNBELT	Growth: Yes	Growth: No	Mean
Yes →	.131	.277	.164
No →	.076	.245	.216
	.12	.25	

The next set of analysis involved the variable of Data System 1 (the use of computers).

The overall variance of .064 was the result of an interaction between the sunbelt cities (r^2 = .028) and growing cities (r^2 = .036).

Table 22 Residualized use of Data System 1 (computers) in percent of cities

SUNBELT	Growth: Yes	Growth: No	Mean
Yes →	.131	.277	.164
No →	.076	.245	.216
	.12	.25	

The r^2 of .064 shows that growing sunbelt cities generally use computers to gather and store data. This concurs with the prior findings: sunbelt cities tend to keep abreast of new innovations in arson investigations.

Data System 1 analysis shows growing cities in non-sunbelt areas also use computers more than cities with declining populations. Examination of growing cities alone shows little difference between sunbelt and non-sunbelt cities.

Table 23 Residualized use of Data System 11 (manual systems) in percent of cities

SUNBELT	Growth: Yes	Growth: No	Mean
Yes	.88	.72	.340
No	.91	.96	.194
	.88	.96	

This is a mirror reflection of the prior analysis. The r^2 for the growing sunbelt cities is .060 as a result of an interaction between sunbelt cities (.034) and the growing cities (.026).

There is once again little difference between the growing cities in the sunbelt and in the northeast. The sunbelt cities, in general, have almost discontinued the use of the manual data systems.

RELATIONSHIP BETWEEN SUNBELT CITIES AND OPERATIONAL MODES

The twelfth set of analysis involved the use of a single department to perform the arson investigations. The results of the analysis showed an r^2 of .132.

Table 24 Relationship Between Sunbelt Cities and the Operational Modes

SUNBELT	Growth: Yes	Growth: No	Mean
Yes →	.548	.500	.537
No →	.154	.194	.180
	.480	.262	

These results indicate half of the sunbelt cities use a single department for arson investigations. Northern (or frostbelt) cities prefer to use a team.

The analysis step involved the residualized variable FD/PD (which department is in charge of arson investigations).

Table 25 Residualized Variable FD/PD -- One Department in Charge

SUNBELT	Growth: Yes	Growth: No	Mean
Yes →	.758	.777	.762
No →	.231	.338	.320
	.666	.437	

Results show a significant r^2 of .197 and indicate sunbelt cities assign fire departments in charge of arson investigations three-fourths (3/4) of the time. This percentage holds true whether a single department or team is used.

Frostbelt cities use the police departments (generally as part of a team) in two-thirds of the time. Data do not indicate a reason for the trend; I believe from personal first-hand observation unionized police in the northern cities are more entrenched having been hired by civil service rules with job descriptions and work assignments dating back to the early part of the century. The present city managers have little to say regarding arson investigation work assignments.

The fourteenth set of analysis involves the residualized variable: FD/PD (team concept with one or the other in charge).

Table 26 Residualized Variable FD/PD (Team Concept)

SUNBELT	Growth: Yes	Growth: No	Mean
Yes →	.548	.444	.52
No →	.153	.161	.16
	.480	.225	

Analysis shows a significant r^2 of .146 indicating fully half of the time sunbelt cities use Fire Departments with the balance investigated by arson teams composed of police officers and firefighters with the fire department in charge half the time.

In sunbelt cities police are in charge of arson investigations only 25 percent of the time.

The final analysis involves the residualized variable training.

Table 27 Residualized Variable: Training

SUNBELT	Growth: Yes	Growth: No	Mean
Yes →	3.75	3.16	3.62
No →	2.84	3.13	3.08
	3.59	3.13	

Analysis results indicate sunbelt cities give significantly more training than any of the other cities. The interaction of growing sunbelt cities shows a significant r^2 of .071.

CHAPTER SIX

CONCLUSIONS AND POLICY IMPLICATIONS

This study's arson investigation results concur with prior findings of The National Institute of Justice showing personnel handling more important than the organizational profile.

Existing reference material, prior to this study, was not as current as desired. However, because of a continual five-year data updating system, a more accurate pool of information is available today than had been in the past. John Regan, Chief Fire Marshal of New York City, reports every county in the state puts all data on fires and arson investigations on a fire reporting system. This procedure will help increase accuracy of future studies.

Arson unit assignments, in the past, were frequently filled by department wide announcements. Investigators were either (a) selected by seniority from a list of volunteers or (b) picked from personnel that could be spared from regular assignments.

Also, according to Chief Regan, the state now has "quality control of Fire Cause Determination" which helps standardize fire reporting terminology.

> The General Municipal Law, enacted in 1979, made fire cause determination mandatory for all New York State fire departments. Section 204-d was further ammended in 1983 to make participation in the NYSFRS (New York State Fire Reporting System) mandatory. These statutes, in conjunction with state-sponsored training in fire reporting and cause and origin determination, have resulted in many more "known fire causes reported."[1]

Many other changes in the investigation of suspicious and incendiary fires have also taken place since the data for this study was collected and additional changes have been made.

Today, arson unit appointments have more status than patrol officer or firefighter and are considered promotions whether or not additional money goes with the assignment. Many city departments (New York City included) now give written examinations or select applicants with prior experience or education.[2]

Staffing, a problem when fire personnel only were used, became a greater problem when the team concept was implemented. Police investigators worked a normal eight-hour, five day, shift. Fire investigators worked sixteen or twenty-four hour shifts followed by two or three days off. Because of the varying shift arrangements, cases could get cold, witnesses moved away or changed their minds about cooperating.[3]

Many jurisdictions are now trying to remedy this by assigning all investigators (especially teams) to a police department shift schedule of eight hours on duty and sixteen hours off for five day work weeks. With shift schedule changes, many team units are finding less conflict between the fire and police team members. All-fire units find case followups easier and yield more results.[4]

The greatest strides have been made in arson investigation training. Of the one hundred and fifty-five cities surveyed, one hundred and seven provided **all** the required investigator training -- including local training courses, state training courses, seminars, and the National Fire Academy course. Eighteen cities gave their investigators **most** of the required training while eighteen cities provided **some** training and nine jurisdictions provided **no** training. (Three cities did not respond.)

Almost all states have firefighting training. Less than one-third offer firefighters classes in investigative training. Many fire and arson investigators have called for standardized training courses to help upgrade the level of arson investigation training.

Since the data in this report were compiled and tabulated, many training changes have already taken place. For example, the National Fire Academy now offers -- in addition to its on-site academy training course -- local around-the-country courses where state fire school instructors are trained with the prospect of developing a strong corps of state-level arson investigation instructors.

Other federal agencies -- Federal Bureau of Investigation and Bureau of Alcohol, Tobacco and Firearms, for example-- offer courses in arson investigation and arson for profit. These agencies, active in training state and local investigators throughout the country, also help to standardize basic investigative techniques.

Many of the nation's district attorneys and state attorneys now join local colleges and universities in offering annual arson seminars. The University of New Haven, in Connecticut, for example, offers a Bachelor of Science Degree in Arson Investigation. In the process, it is developing a corps of highly-educated arson investigators with strong foundations in physical sciences.

The only national system to collect detailed information on all fire types at the incident level was established in 1975 by The National Fire Prevention and Control Administration (known today as the U.S. Fire Administration). Called the National Fire Incident Reporting System (NFIRS), it is a cooperative effort of local state and federal authorites to improve uniformity of fire reports and to ensure use of common definitions in data presentation.

In the 1980 Abt Associates study, not every jurisdiction used the National Fire Incident Reporting System (NFIRS).[5]

Many non-participating cities used manual systems to tabulate data and did not use all the supplied data. Of the one hundred and fifty-five jurisdictions tabulated: (a) one city used the data to find vulnerable locations, (b) one used the data to locate vulnerable buildings, and (c) twelve used the data to study arsonists' modus operandi.

While twenty-three cities used the data system for two of the three available data items, one hundred and seventeen cities did not acknowledge: (a) use of the data system to gather information on potential arsonists' modus operandi, (b) location of vulnerable buildings, or (c) vulnerable locations.

NFIRS use has increased annually since its inception. "In 1984, thirty-four states, plus the District of Columbia, submitted data on over 750,000 incidents reported by almost 11,000 participating fire departments.[6] Chief O'Bier, Secretary of New England Fire Marshal's Association, believes from 150 to 200 of the largest U.S. cities are now part of the system.[7] Continued NFIRS use is the best evidence of its effectiveness.

As more jurisdictions began to use available federal training, the level and standardization of training of U.S. fire and arson investigators increased. Along with standardized training, the use of standard report forms and the NFIRS became more widespread. This increased systems use helped make data more accurate and, for the first time, established a comprehensive longitudinal and cross site statistical study of fire and arson.

In addition, results of administrative efforts by some jurisdictions were published in professional journals describing how such efforts could help reduce arson. Some of the more successful efforts -- posting and boarding-up of vacant buildings, rewards for arson and arsonists information, posting of local arson unit number encouraging citizens to call with information, formation of neighborhood

watch groups, utilization of show-of-force -- have been copied by most other jurisdictions.

In the past, insurance companies were at times threatened with civil law suits for disclosing confidential information on insured companies. This posed a problem and tended to limit cooperation between arson investigators and insurance companies.

In 1976, the Ohio legislature enacted a law granting insurance companies immunity from civil suits for sharing arson-related information with law enforcement officials. In 1977, the Alliance of American Insurers drafted model legislation called Arson Reporting Immunity Bill.

The law's major purpose was to permit insurers and arson investigators to exchange information regarding the fire under investigation and the insurance policy holder. This two-way information flow enabled investigators to evaluate the fire using available financial information and to compile a history of insurance claims filed by the suspect. By 1986, forty-six states adopted similar legislation and the Model Reporting Immunity Law became another effective weapon in combating arson.[8]

Finally, task force use had come unto its own. When the National Institute of Law Enforcement did its 1979 survey, only seventy-six of the one hundred and fifty-five jurisdictions responded affirmatively when asked if they used the arson task force concept. With the passage of the Anti-Arson Act of 1982 (PL 97-298) on October 12, the Bureau of Alcohol, Tobacco, and Firearms was directed to expand its mission to include arson investigation. The A.T.F. responded to this by sending "flying teams" around the country in response to requests from local strike forces for investigation help. With this new federal effort the number of jurisdictions using the task force concept increased one hundred percent.

Although this study's results may be inconclusive as the type of unit most efficient in arrests, it does agree, in many respects, with previous studies. Recent advances -- upgrading and standardizing of training and reports, use of data systems and task force -- have helped jurisdictions around the country to even-out major differences among units. Remaining differences center around the question of jurisdiction in a city's arson investigation: police or fire department or a team composed of members from each department.

This study shows many extraneous variables (social-economic) have little effect on arson clearance rates. Recent advances in the quasi-independent variables (organizational setting) have become generally similar with minor expectations leaving the main difference between units still being the "true" independent variable.

All-in-all this study isolates the following factors:

1. Physical condition of the city
2. Computer use
3. Emphasis on training
4. Responsibility for arson investigation

At the same time, however, these factors emerged as continuing problems in the field: what accounts for the number of (a) fires investigated, (b) incendiary fires, (c) arrests, and (d) fatalities.

We also need to know **why** some organizations opt for the following -- or combination of -- methods to control arson:

1. Task force
2. Show of force
3. Reward for information

Looking to the future, the arson investigation professional will need to be aware of and concerned about:

1. Organization differences exhibited by the growing/sunbelt cities in: computer use, training and fire department leadership in arson investigation, and

2. Actual payoff in terms of investigative efficiency.

Otherwise, research can only conclude that to solve arson investigation problems, an existing city must become *a new growing sunbelt city.*

As a fire consultant, professor of professional studies and Director of Fire Science at the University of New Havan with more than 30 years in the field (firefighter covering over 10,000, investigator for 15,000 fires with 300 arrests and college arson instructor) I strongly believe there is a difference in the efficiency of one type of investigational unit over the other in the number of clearances it makes, by arrest, per number of arson cases investigated. If this is true, the information in this study is important to future researchers studying other areas where department "turf" battles are still being waged.

FOOTNOTES

[1] Francis A. McGarry, A Review of New York States' Arson Program 1979-1983. (Albany, N.Y., Office of State Fire Administration, 1985), p. 35.

[2] John Regan, Chief Fire Marshal, New York, N.Y., Interview November 15, 1987.

[3] John O'Bier, Chief North Haven Fire Department, Sec. New England Fire Marshals' Association, North Haven, CT, Interview November 24, 1987.

[4] John Regan, Chief Fire Marshal, New York, N.Y., Interview November 15, 1987.

[5] Louis O. Giuffrida, Director "The National Fire Incident Reporting Systems (NFIRS)" FEMA Newsletter, (Washington, D.C.: U.S. Federal Emergency Management Agency, March/April 1985), p. 5.

[6] Ibid.

[7] John O'Bier, Chief North Haven Fire Department, Sec. New England Fire Marshals' Association, North Haven, CT, Interview November 24, 1987.

[8] Frank D. Hart, "Arson-for-Profit: A National Challenge," The Police Chief, Volume L1, November 8, August 1984, p. 51.

APPENDIX A

QUESTIONNAIRE DATA SHEETS

	Population (1975 Census)	Budget	Fires in Buildings	Not Accidental	Incendiary & Suspicious	Incendiary	Investigated	Arrested	Arson Fatalities	Number of Arson Personnel	Responsible for Investigation	Data System	Uses of Data
New York City	7,428,000	$388M	54,486	13,178	8,810	4,576	5,427	424	42	163FD	FD	M	N/A
Chicago	3,099,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	(Police Department Only)				N/A
Los Angeles	2,727,000	98M	8,176	1,634	1,060	817	1,499	201	4	24FD	FD	Bo	MO,VL
Philadelphia	1,815,000	57M	6,834	2,443	1,869	N/A	N/A	324	19	19FD/4PD	FD/PD*	M	N/A
Detroit	1,335,000	65M	9,024	5,029	2,153	2,153	3,591	359	10	24FD/6PD	FD*/PD	Bo	MO,VL
Houston	1,326,000	64M	3,186	1,314	1,227	1,227	1,227	262	3	47FD	FD	M	N/A
Baltimore	851,000	52M	5,882	1,013	934	855	285	236	N/A	11FD	FD/PD*	M	N/A
Dallas	812,000	34M	3,212	835	799	799	3,451	487	4	18FD	FD	M	N/A
Indianapolis	782,000	20M	3,000	614	186	153	638	121	1	9FD	FD	Bo	MO
San Diego	774,000	19M	2,020	695	608	608	618	81	1	8FD	FD	M	N/A
San Antonio	773,000	18M	2,577	798	430	430	916	63	N/A	6FD	FD	Bo	N/A
Washington, D.C.	711,000	51M	2,700	N/A	N/A	N/A	N/A	N/A	N/A	4PD/4FD	FD/PD*	Bo	MO,VL
Milwaukee	665,000	32M	2,474	N/A	547	547	N/A	N/A	N/A	None	PD	N/A	N/A
Phoenix	664,000	22M	5,887	931	840	840	1,520	96	0	8FD/5PD	FD/PD*	Bo	MO
San Francisco	664,000	63M	2,823	595	570	570	N/A	33	4	9FD	FD	Bo	N/A
Memphis	661,000	33M	5,400	N/A	519	380	4,606	81	3	4FD/2PD	FD/PD	M	N/A
Cleveland	638,000	24M	N/A	N/A	779	535	779	89	N/A	10FD	FD/PD	M	N/A
Boston	636,000	N/A	N/A	746	431	186	1,700	103	N/A	20FD	FD/PD*	M	MO,VL
Jacksonville	562,000	18M	949	269	210	175	499	39	0	9FD	FD	M	N/A
New Orleans	559,000	20M	2,863	1,256	756	283	756	10	0	2FD/PD	FD/PD*	M	N/A
San Jose	555,000	15M	1,273	858	550	289	615	86	3	5FD	FD	Bo	MO,VL
Seattle	487,000	25M	1,712	N/A	518	518	448	69	N/A	9FD/2PD	FD/PD	C	MO,VL
Denver	484,000	N/A	2,024	949	866	N/A	1,398	351	0	12FD	FD	Bo	MO,VL
Kansas City, MO	472,000	23M	2,182	N/A	N/A	N/A	155	40	3	6FD	FD/PD	Bo	MO,VL
Atlanta	436,000	N/A	1,740	544	301	291	544	35	N/A	5FD	FD	M	N/A
Cincinnati	412,000	16M	2,295	454	451	441	488	228	4	8FD	FD	M	N/A
Buffalo	407,000	16M	2,971	683	506	N/A	506	87	27	N/A	FD/PD*	M	N/A
Minneapolis	378,000	12M	3,099	N/A	N/A	N/A	N/A	N/A	2	7FD	FD	M	N/A
Omaha	371,000	12M	1,149	N/A	N/A	N/A	540	58	N/A	3FD	FD/PD*	M	N/A
Toledo	367,000	10M	2,365	N/A	607	607	N/A	N/A	2	2FD/2PD	FD/PD*	M	N/A
Oklahoma City	366,000	13M	1,872	N/A	290	290	439	43	6	8FD	FD	M	N/A
Miami	365,000	21M	1,100	N/A	246	246	281	12	N/A	6FD	FD	M	N/A
Fort Worth	358,000	14M	559	289	253	253	253	27	0	6FD	FD	Bo	N/A
Newark	340,000	19M	2,642	N/A	N/A	N/A	1,870	182	4	14FD	FD	M	N/A
Louisville	336,000	N/A	2,460	N/A	232	N/A	663	172	N/A	13FD	FD	M	N/A
Long Beach	336,000	22M	2,167	N/A	N/A	N/A	400	54	1	3FD	FD	Bo	N/A
Tulsa	332,000	10M	3,415	242	165	124	545	35	N/A	17FD	FD	M	N/A
Oakland	331,000	18M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3FD	FD/PD	C	N/A
Austin	301,000	8M	555	181	126	95	95	70	0	4FD	FD	M	N/A
Tucson	296,000	N/A	1,788	N/A	N/A	N/A	1,010	51	N/A	3FD/2PD	FD/PD*	C	MO
Contra Costa Co.	300,000	10M	589	162	112	112	125	6	0	1FD/6(Pt)	FD	M	N/A

Key: N/A = Not Available
FD = Fire Department
PD = Police Department
* = Lead responsibility
M = Manual Data System
C = Computer Data System
Bo = Both Manual and Computer Data Systems
MO = Modus Operandi
VL = Vulnerable Location
VB = Vulnerable Building
(Pt) = Part-time

APPENDIX A

	Population (1975 Census)	Budget	Fires in Buildings	Not Accidental	Incendiary & Suspicious	Incendiary	Investigated	Arrested	Arson Fatalities	Number of Arson Personnel	Responsible for Investigation	Data System	Uses of Data
Tampa	280,000	14.8M	753	148	123	71	71	N/A	3	5(Pt)	FD	M	N/A
St. Paul	279,535	9.9M	1,046	380	342	204	204	N/A	42	3FD	FD/PD*	M	MO/YL
Albuquerque	279,000	11.7M	2,631	N/A	N/A	1,287	474	33	1	9	FD	Bo	YB
Birmingham	276,000	N/A	1,602	486	281	281	224	8	0	7	FD	M	N/A
Rochester	267,000	12.9M	1,725	615	357	357	1,120	67	0	6	FD	M	MO
Wichita	264,000	5.1M	718	75	73	52	206	19	N/A	N/A	FD/PD	C	MO,YB
Akron	251,000	7.2M	949	325	196	122	196	28	0	4	FD	M	N/A
Jersey City	243,000	N/A	2,027	305	99	35	588	40	N/A	10FD	FD/PD*	Bo	MO,YL
St. Petersburg	234,000	N/A	761	126	110	41	41	N/A	0	N/A	FD/PD*	M	MO,YB
Richmond	232,000	9.0M	3,121	286	286	71	N/A	N/A	N/A	N/A	PD	C	N/A
Virginia Beach	213,000	3.9M	1,235	N/A	113	113	343	29	0	4	FD	M	N/A
Dayton	205,000	12.5M	N/A	N/A	409	409	409	27	0	6	FD/PD*	C	N/A
Anaheim	193,000	8.4M	414	N/A	N/A	N/A	N/A	N/A	N/A	N/A	FD	Bo	MO,YL
Shreveport	185,000	6.4M	1,940	432	66	66	94	18	N/A	N/A	FD	M	N/A
Fort Wayne	185,000	4.1M	1,112	123	100	91	91	5	0	9	FD/PD	M	MO,YL
Syracuse	182,000	8.8M	707	241	163	105	181	29	1	5	FD/PD	Bo	N/A
Colorado Springs	179,000	4.6M	650	N/A	120	N/A	N/A	N/A	N/A	3	FD	M	MO,YL
Santa Ana	177,000	7.9M	446	162	158	147	239	23	N/A	3	FD	M	N/A
Fresno	176,000	9.0M	N/A	367	N/A	83	97	19	0	6	FD/PD	C	MO
Flint	174,000	10.0M	702	N/A	255	255	601	128	N/A	2	FD/PD	M	N/A
Worcester	171,000	N/A	704	197	197	N/A	N/A	N/A	N/A	6PD/3(Pt)	FD/PD*	M	N/A
Salt Lake City	169,000	8.6M	4,330	1,694	76	43	181	13	N/A	4	FD/PD*	M	N/A
Madison	168,000	8.1M	341	123	71	71	43	20	0	N/A	FD/PD*	M	MO
Kansas City, KS	168,000	7.2M	1,560	N/A	N/A	N/A	210	18	0	2	FD/PD*	M	N/A
Arlington, VA	166,000	N/A	N/A	N/A	N/A	N/A	964	N/A	0	N/A,7(Pt)	Co. FD	M	N/A
Jackson, MS	166,000	5.2M	777	N/A	98	94	N/A	11	0	4	FD	M	N/A
Anchorage	161,000	15.8M	451	142	126	N/A	126	44	0	3	FD	Bo	N/A
Montgomery	153,000	4.4M	622	180	154	100	155	9	3	6	FD	M	MO
Tacoma	151,000	8.5M	790	N/A	179	104	264	23	1	9(Pt)	PD/FD	Bo	N/A

Key: N/A = Not Available
FD = Fire Department
PD = Police Department
* = Lead responsibility
M = Manual Data System
C = Computer Data System
Bo = Both Computer and Manual Data Systems
MO = Modus Operandi
YL = Vulnerable Location
YB = Vulnerable Building
(Pt) = Part-time
S = Sometimes

APPENDIX A

	Population (1975 Census)	Budget	Fires in Buildings	Not Accidental	Incendiary & Suspicious	Incendiary	Investigated	Arrested	Arson Fatalities	Number of Arson Personnel	Responsible for Investigation	Data System	Uses of Data
Somerville, MA	81,000	4.3M	278	112	81	26	N/A	N/A	N/A	1FD/1PD	FD/PD*	M	MO,VL
Salem, OR	78,000	N/A	228	N/A	49	49	N/A	N/A	0	(Pt)	FD/PD*	M	N/A
Laredo, TX	77,000	2.3M	115	95	20	9	11	0	0	2FD	FD	M	N/A
Taylor, MI	77,000	1.8M	792	677	386	39	N/A	10	N/A	4FD	FD/PD*	Bo	MO
Lawton, OK	76,000	1.9M	516	117	31	36	51	6	0	3FD(Pt)	FD/PD	M	MO,VL
Wilmington, DE	76,000	5.0M	1,493	353	277	108	353	24	0	(Pt)	FD/PD*	Bo	MO,VL
Pontiac, MI	76,000	4.7M	400	N/A	N/A	N/A	N/A	0	0	4FD(Pt)	FD/PD*	M	N/A
Cranston, RI	74,000	2.1M	271	60	60	40	22	4	0	N/A	FD/PD*	M	N/A
Sioux Falls, SD	74,000	1.9M	689	N/A	32	32	6	2	3	3FD(Pt)	FD/PD*	M	N/A
Daly City, CA	73,000	1.8M	187	N/A	40	40	46	N/A	N/A	3FD/2PD(Pt)	FD/PD	M	N/A
Pawtucket, RI	72,000	3.0M	113	36	36	1	N/A	N/A	N/A	(Pt)	FD/PD*	M	N/A
Alameda, CA	72,000	2.4M	136	48	38	32	38	6	0	3FD(Pt)	FD/PD	M	N/A
Vallejo, CA	71,000	2.9M	347	N/A	26	26	N/A	N/A	N/A	3FD(Pt)	FD/PD	M	N/A
Salinas, CA	70,000	2.3M	236	N/A	113	113	N/A	5	1	2FD(Pt)	FDorPD	N/A	N/A
Arlington Hts, IL	70,000	2.2M	291	173	55	44	N/A	N/A	N/A	4FD	FD/PD*	M	MO,VL
Anderson, IN	69,000	2.3M	780	63	56	25	56	4	N/A	5(Pt)	FD/PD	M	N/A
Tuscaloosa, AL	69,000	2.5M	578	N/A	N/A	N/A	102	8	0	3FD(Pt)	FD	M	N/A
Billings, MT	69,000	N/A	626	45	43	29	85	6	0	3FD	FD	C	MO,VL
Mount Vernon, NY	68,000	2.0M	245	N/A	99	89	N/A	N/A	N/A	(Pt)	FD/PD*	M	N/A
Lawrence, MA	67,000	3.9M	315	127	87	52	120	12	10	2PD/2FD	FD/PD	M	N/A
Clearwater, FL	67,000	3.4M	201	55	53	45	45	18	0	7FD(Pt)	FD/PD	M	MO;VL
Waukegan, IL	65,000	3.5M	334	N/A	51	51	N/A	N/A	N/A	(Pt)	FD/PD*	M	N/A
Pensacola, FL	64,000	3.2M	322	47	20	8	86	3	2	3FD(Pt)	FD/PD*	M	N/A
Ventura, CA	63,000	2.3M	219	42	13	8	42	1	1	3FD(Pt)	FD/PD*	M	N/A
Ontario, CA	63,000	2.9M	270	148	139	46	352	21	N/A	4FD(Pt)	FD/PD	Bo	N/A
Midland, TX	63,000	1.6M	165	N/A	8	8	216	3	0	7FD(Pt)	FD	M	N/A
Oak Lawn, IL	62,000	2.3M	N/A	N/A	N/A	N/A	57	0	0	3FD(Pt)	FD/PD*	M	N/A
Buena Park, CA	62,000	2.2M	155	138	N/A	67	N/A	0	N/A	N/A	FD/PD*	M	N/A
Dubuque, IA	62,000	2.5M	139	N/A	N/A	N/A	N/A	N/A	N/A	(Pt)	FD/PD*	M	N/A
Tyler, TX	61,000	1.5M	434	36	33	27	27	10	0	3FD(Pt)	FD	M	N/A
Monroe, LA	61,000	1.8M	54	25	5	2	25	2	0	3FD	FDorPD	M	N/A
Medford, MA	61,000	2.5M	121	N/A	N/A	N/A	N/A	N/A	N/A	1FD(Pt)	FD/PD*	M	N/A
Galveston, TX	60,000	1.9M	104	35	25	25	25	11	0	3FD(Pt)	FP	M	N/A
Portland, ME	60,000	2.6M	429	99	71	51	N/A	N/A	N/A	N/A	PD	M	N/A
Richardson, TX	59,000	1.8M	164	22	17	15	164	5	0	22FD(Pt)	FD	M	N/A
Champaign, IL	58,000	1.7M	366	245	125	50	265	10	0	3FD	FD/PD*	M	MO
Harrisburg, PA	58,000	1.6M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1FD	FD/PD	M	N/A
Irvington, NJ	58,000	2.6M	446	233	96	96	32	1	0	1FD/1PD	FD/PD*	M	N/A
Grand Prairie, TX	57,000	1.2M	212	52	40	16	212	2	0	4FD(Pt)	FD	M	N/A
Lancaster, PA	57,000	2.0M	393	61	47	37	66	9	0	4FD(Pt)	FD/PD*	M	N/A
Rochester, MN	56,000	2.0M	158	19	17	7	7	1	0	3FD(Pt)	FD/PD*	M	N/A
Oceanside, CA	56,000	2.6M	154	N/A	N/A	N/A	63	0	N/A	3FD/2PD(Pt)	FD/PD*	M	N/A
Des Plains, IL	56,000	2.1M	83	N/A	23	N/A	23	0	0	5FD(Pt)	FD/PD*	M	N/A
Provo, UT	56,000	.7M	N/A	N/A	N/A	N/A	10	0	0	1FD/1PD(Pt)	FD/PD*	Bo	N/A
Troy, MI	55,000	.8M	104	N/A	24	24	24	0	0	N/A	FD/PD*	Bo	N/A
Vineland, NJ	54,000	.5M	301	N/A	N/A	N/A	63	8	0	4FD/1PD(Pt)	FD/PD*	M	MO,VL

Key: N/A = Not Available
FD = Fire Department
PD = Police Department
FP = Fire Prevention Department
* = Lead responsibility
M = Manual Data System
C = Computer Data System
Bo = Both Manual and Computer Data Systems
MO = Modus Operandi
VL = Vulnerable Locations
(Pt) = Part-time

APPENDIX A

	Population (1975 Census)	Budget	Fires in Buildings	Not Accidental	Incendiary & Suspicious	Incendiary	Investigated	Arrested	Arson Fatalities	Number of Arson Personnel	Responsible for Investigation	Data System	Uses of Data
Winston-Salem	141,000	3.7M	489	82	65	39	164	68	0	1PD/1FD	FD/PD	C	N/A
Torrance, CA	139,000	5.9M	257	N/A	N/A	N/A	189	8	0	1FD/4(Pt)	FD	Bo	N/A
Paterson, NJ	136,000	7.3M	490	213	153	116	274	N/A	N/A	N/A	FD/PD*	M	N/A
Glendale, CA	132,000	6.0M	259	268	47	47	47	1	0	3FD/2PD(Pt)	FD/PD*	C	N/A
Lansing, MI	126,000	5.4M	373	N/A	67	65	253	45	0	6FD/2PD(Pt)	FD/PD*	M	N/A
Peoria	126,000	4.7M	543	108	72	24	372	N/A	0	4FD	FD/PD*	M	N/A
Hamilton, VA	125,000	2.6M	298	N/A	78	N/A	78	10	1	1FD	FD/PD*	M	N/A
Aurora, CO	118,000	4.5M	464	N/A	N/A	N/A	N/A	N/A	N/A	4FD	FD	M	N/A
Fremont, CA	117,000	3.4M	378	N/A	58	N/A	58	N/A	0	5FD(Pt)	FD/PD	M	N/A
Stockton, CA	117,000	N/A	507	N/A	N/A	324	324	25	1	1FD/1PD	FD/PD	M	MO
South Bend, IN	117,000	3.8M	1,427	N/A	202	202	202	25	0	2FD/2PD(Pt)	FD/PD	(M-PD C-PD)	YL
Livona, MI	114,000	2.9M	194	113	71	40	35	3	0	2FD/1PD(Pt)	FD/PD*	M	N/A
Beaumont, TX	113,000	4.0M	567	89	55	51	603	30	7	4FD/2PD(Pt)	FD	C	N/A
Arlington, TX	110,000	3.1M	366	249	N/A	98	386	7	0	3FP(Pt)	FD/PD*	M	N/A
Cedar Rapids, IA	109,000	2.4M	815	N/A	17	17	17	2	0	5FD(Pt)	FD/PD*	M	N/A
Portsmouth, VA	108,000	3.3M	448	244	55	24	55	8	0	4FD(Pt)	FD	Bo	N/A
Allentown, PA	106,000	2.5M	1,317	N/A	52	52	All	0	N/A	1FD(Pt)	FD/PD*	M	N/A
Stamford, CT	105,000	4.7M	121	53	23	14	35	0	N/A	N/A	FD/PD*	M	N/A
Ann Arbor, MI	103,000	2.9M	145	N/A	80	80	183	22	N/A	4FD(Pt)	FD/PD	M	MO
Trenton, NJ	101,000	5.2M	1,013	121	114	114	114	15	0	2FD(Pt)	FD/PD*	M	N/A
Durham, NC	101,000	1.8M	509	N/A	23	23	90	N/A	N/A	3PD/FD(Pt)	FD/PD*	M	N/A
Fall River, MA	100,000	4.9M	390	224	N/A	83	214	37	0	3FD/2PD	FD/PD*	M	N/A
Davenport, IA	99,999	3.2M	842	N/A	74	32	74	10	2	3FP	FD	Bo	N/A
Brockton, MA	95,878	N/A	279	78	57	35	N/A	N/A	N/A	1PD(Pt)	FD/PD*	M	N/A
Racine, WI	94,000	3.1M	163	N/A	32	N/A	443	30	0	1FD/1PD	FD/PD*	M	MO,YL
Duluth, MN	94,000	3.2M	436	101	72	69	115	4	0	N/A	FD	M	N/A
Fullerton, CA	93,000	2.2M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Eugene, OR	92,000	5.0M	340	102	83	83	83	14	0	6FD/2PD(Pt)	FD/PD	C	N/A
Quincy, MA	91,000	6.5M	432	56	34	25	N/A	N/A	N/A	3FD(Pt)	FD/PD*	N/A	N/A
Decatur, IL	89,000	2.4M	690	N/A	71	71	71	N/A	N/A	3FD(Pt)	FD/PD*	M	MO
Springfield, IL	87,000	4.1M	850	N/A	134	N/A	134	6	0	4FD(Pt)	FD/PD	M	MO
Sterling, MI	87,000	3.0M	251	375	115	115	N/A	N/A	N/A	2FD(Pt)	FD/PD*	N/A	N/A
Saginaw, MI	86,000	2.9M	475	193	162	162	162	12	0	3FD(Pt)	FD/PD*	M	N/A
Burbank, CA	86,000	4.2M	353	N/A	80	80	N/A	N/A	0	3FD	FD	C	N/A
Downey, CA	85,000	2.9M	331	352	N/A	61	413	3	0	2FD(Pt)	FD	C	N/A
Odessa, TX	84,000	2.4M	279	N/A	19	19	19	0	N/A	7FP(Pt)	FD	M	N/A
Tempe, AR	84,000	1.8M	181	N/A	47	N/A	47	0	N/A	FD(Pt)	FD/PD*	M	N/A
Kenosha, WI	80,000	2.9M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3FD	FD/PD	M	N/A
Kalamazoo, MI	79,000	3.1M	503	183	138	80	138	4	0	2FD(Pt)	FD	M	N/A

Key: N/A = Not Available
FD = Fire Department
PD = Police Department
FP = Fire Prevention Department
* = Lead responsibility
M = Manual Data System
C = Computer Data System
Bo = Both Manual and Computer Data Systems
MO = Modus Operandi
VL = Vulnerable Location
(Pt) = Part-time
S = Sometimes

APPENDIX A (continued)

City	Task Force	Post B'ldg	Show Force	Offer Reward	Publish Phone #	Citizen Groups	Board up B'ldgs.	Train
New York City	yes	x	x	x	x	x	x	all
Chicago	n/a							n/a
Los Angeles	yes							all
Philadelphia	yes				x	x	x	all
Detroit	yes	x	x	x	x	x	x	all
Houston	yes		x	x		x		all
Baltimore	no	x	x	x	x	x	x	most
Dallas	yes	x		x	x	x	x	all
Indianapolis	no							all
San Diego	yes							some
San Antonio	yes					x	x	all
Washington, D.C.	yes							all
Milwaukee	no							none
Phoenix	yes							all
San Francisco	yes	x	x	x	x	x	x	all
Memphis	yes	x	x	x	x	x	x	all
Cleveland	yes				x	x	x	all
Boston	yes	x	x	x	x	x	x	most
Jacksonville	no					x	x	all
New Orleans	no						x	none
San Jose	no			x	x	x	x	all
Seattle	yes	x	x	x	x	x	x	all
Denver	yes			x	x	x	x	all
Kansas City, Mo.								
Atlanta	yes						x	some
Cincinnati	yes	x		x	x	x	x	all
Buffalo	yes	x		x	x	x	x	all
Minneapolis	no	x		x	x	x	x	all
Omaha	yes					x		all
Toledo, Oh	yes	x		x	x	x		all
Oklahoma City	yes	x	x	x	x	x	x	all
Miami	yes		x				x	all

APPENDIX A (continued)

City	Task Force	Post B'ldg	Show Force	Offer Reward	Publish Phone #	Citizen Groups	Board up B'ldgs	train
Fort Worth	no			x		x	x	all
Newark	yes	x			x	x		all
Louisville	no		x	x		x	x	all
Long Beach	yes		x				x	all
Tulsa	yes				x	x		all
Oakland	yes					x	x	all
Austin	no			x			x	all
Tucson	no						x	all
Contra Costa, Co.	no							all
Tampa	no			x			x	all
St. Paul	yes	x		x	x	x	x	all
Albuquerque	yes		x	x	x		x	all
Birmingham	no		x				x	all
Rochester	no					x	x	all
Wichita	no							all
Akron	yes						x	all
Jersey City	no		x			x	x	all
St. Petersburg	no						x	all
Richmond	n/a							some
Virginia Beach	no	s		x	x	x		all
Dayton	yes	x	x	x	x	x	x	all
Anaheim	no	x		x	x			all
Shreveport	no		x	x		x	x	all
Fort Wayne	yes	x	x	x	x	x	x	all
Syracuse	yes					x	x	all
Colorado Springs	yes			x	x	x	x	all
Santa Ana	no							all
Fresno	no						x	all
Flint	yes			x				none
Worcester	yes		s		x	x	x	most
Salt Lake City	no					x	x	all
Madison	yes	x		x	x	x	x	all
Kansas City, KS	no							none

APPENDIX A (continued)

City	Task Force	Post B'ldg	Show Force	Offer Reward	Publish Phone #	Citizen Groups	Board up B'ldgs	train
Arlington, VA	no		x	s		x	x	all
Jackson, MS	yes	x		x	x			all
Anchorage	yes	x		x	x			all
Montgomary	yes		x		x	x	x	all
Tacome	yes							all
Winston-Salem	yes			s			x	all
Torrance, CA	yes					x	x	all
Paterson, N.J.	yes					x	x	most
Glendale, CA	no	x		x	x	x	x	none
Lansing, MI	yes	x		x	x	x	x	some
Peoria	yes				x			none
Hamiltin, VA	yes						x	all
Aurora, CO	yes			x				all
Fremont, CA	no						x	most
Stockton, CA	yes		x	s	x	x	x	all
South Bend, IN	yes		x	x		x	x	some
Livona, MI	no			x	x	x	x	all
Beaumont, TX	no			x		x	x	all
Arlington, TX	no			x	x	x	x	all
Cedar Rapids, IA	no						x	most
Portsmouth, VA	no		x		x	x	x	all
Allentown, PA	n/a							all
Stamford, CT	no					x	x	none
Ann Arbor, MI	yes						x	most
Trenton, N.J.	no						x	none
Durham, NC	yes			x		x	x	most
Fall River, MA	yes					x	x	most
Davenport, IA	yes						x	all
Brocton, MA	no						x	some
Racine, WI	no			x	x	x	x	all
Duluth, MN	no	x		x	x	x	x	all
Fullerton, CA	n/a							n/a

APPENDIX A (continued)

City	Task Force	Post B'ldg	Show Force	Offer Reward	Publish Phone #	Citizen Groups	Board up B'ldgs	train
Eugene, OR	no					x	x	all
Quincy, MA	no						x	most
Decatur, IL	no					x		most
Springfield, IL	yes						x	all
Sterling, MI	no	x		x	x	x		some
Saginaw, MI	no	x		x	x	x	x	most
Burbank, CA	no	x		x	x	x	x	most
Downey, CA	yes	x		x	x		x	some
Odessa, TX	no			x		x	x	all
Tempe, AR	yes						x	most
Kenosha, WI	no						x	all
Kalamazoo, MI	no				x	x	x	all
Somerville, MA	yes		x			x	x	all
Salem, OR	yes						x	all
Laredo, TX	yes		x	x		x	x	all
Taylor, MI	yes			x		x	x	all
Lawton, OK	no					x	x	most
Wilmington, DE	no			x		x	x	all
Pontiac, MI	yes							most
Cranston, RI	yes		x			x	x	some
Sioux Falls, SD	no						x	most
Daly City, CA	yes						x	all
Pawtucket, RI	no					x		all
Alameda, CA	yes	x		x	x	x	x	all
Vallejo, CA	no			x	x		x	all
Salimas, CA	n/a						x	all
Arlington Hts, IL	yes							all
Anderson, IN	no						x	all
Tuscaloosa, AL	yes			x		x	x	all
Billings, MT	yes						x	all
Mount Vernon, N.Y.	yes		x		x	x	x	some
Lawrence, MA	yes							all

APPENDIX A (continued)

City	Task Force	Post B'ldg	Show Force	Offer Reward	Publish Phone #	Citizen Groups	Board up B'ldgs	train
Clearwater, FL	yes		x	x		x		all
Waukegan, IL	no			x		x	x	some
Pensacola, FL	yes						x	some
Ventura, CA	no						x	most
Ontario, CA	yes	x		x	x	x	x	all
Midland, TX	no			x		x	x	all
Oak Lawn, IL	no							some
Buena Park, CA	no						x	none
Dubuque, IA	no							all
Tyler, TX	no			x		x	x	all
Monroe, LA	no							all
Medford, MA	no						x	all
Galveston, TX	no			x		x	x	all
Portland, ME	yes						x	some
Richardson, TX	no			x		x	x	all
Champaign, IL	yes			x	x	x	x	all
Harrisburg, PA	no					x		all
Irvington, N.J.	no					x	x	all
Grand Prairie, TX	no			x				all
Lancaster, PA	yes						x	all
Rochester, MN	no			x			x	none
Oceanside, CA	yes						x	all
Des Plains, IL	no							none
Provo, UT	no				x		x	some
Troy, MI	no			x	x			most
Vineland, N.J.	yes			x		x	x	all

CITIES	UNITS PER DWELLING by % SINGLE	5 or MORE	DEN-SITY PER MILE	% POP. CHANGE 70-75	% BLACKS	% HISP.	PER CAPITA INCOME AVE.	MED. FAMILY INCOME	MED. BLACK FAMILY INCOME
New York	25.7	25.8	24,964	- 5.2	21.1	19.9	4939	9673	7146
Chicago	14.9	78.8	13,911	- 8	32.7	14.0	4689	10239	7883
Los Angles	28.8	70.4	5,879	- 3	17.9	27.5	5277	10530	7198
Philadelphia	31.4	34.7	14,131	- 6.9	33.5	3.8	4330	9361	7373
Detriot	1.1	98.3	9,675	-11.8	43.6	2.4	4463	10038	8639
Houston	20.1	78.2	2,744	5.9	25.3	17.6	5110	9874	6391
Baltimore	21	79	10,877	- 6	46.4	1.0	4330	8814	7287
Dallas	47.2	52.5	3,006	- 3.6	24.9	12.3	5285	10009	6309
Indianapolis	39.5	58.6	1,995	- 1.5	16.9	.9	4922	10815	7848
San Diego	56.5	43	3,965	7.5	11	14.9	5016	10159	7408
San Antonio	50.2	48	2,935	9.1	7.1	53.7	3601	7731	5373
Washington, DC	49.3	45.7	11,588	- 6	71.1	2.8	5659	9576	8483
Milwaukee	27.1	62	7,008	- 7.2	14.6	4.1	4680	10255	7478
Phoenix	80.4	18.6	2,467	12.9	4.7	3.8	4942	9953	5621
San Francisco	24.2	58.2	14,637	- 3.3	13.4	12.3	5990	10495	7676
Memphis	54.6	37.9	2,401	.7	36.9	.8	4044	8646	5177

CITIES	UNITS PER DWELLING by % SINGLE	5 or MORE	DEN-SITY PER MILE	% POP. CHANGE 70-75	% BLACKS	% HISP.	PER CAPITA INCOME AVE.	MED. FAMILY INCOME	MED. BLACK FAMILY INCOME
Cleveland	4.1	90	8,416	-14.9	14.8	3.1	3925	9098	7608
Boston	2.8	92.1	13,842	- .7	16.3	6.4	4157	9133	6344
Jacksonville	76.2	25.6	.734	6.3	22.3	1.8	4615	8669	5122
New Orleans	84.7	11.4	2,840	- 5.7	45	3.4	4029	7442	4743
San Jose	77.3	18.7	3,742	20.5	2.4	22.3	4972	11926	10221
Seattle	34	52.9	5,826	- 8.2	7.1	2.6	5800	11032	8459
Denver	51.1	49.9	5,090	- 5.9	9.1	18.8	5585	9650	7270
Kansas City Mo.	52.3	22.9	1,494	6.9	22.1	3.3	4736	9964	7241
Atlanta	23.2	75.4	3,316	-11.9	51.7	1.4	4527	8398	6450
Cincinnatti	10.7	85.4	5,283	- 9	27.6	.8	4517	8894	6502
Buffalo	17.1	71.4	9,859	-12	20.4	2.7	3928	8794	6899
Minneapolis	45.4	47	6,813	-13	4.4	1.3	5161	9958	7351
Omaha	96.4	.6	4,586	3.6	9.6	2.3	4887	10206	6320
Toledo	40.6	57.1	4,528	- 4	32.2	3.0	4571	10452	7567
Oklahoma City	94.2	--	345	- .6	.9	2.8	4731	9098	5914
Miami	8.4	64	10,644	.9	22.7	55.9	4416	7299	5640
Fort Worth	79.4	13.9	1,569	- 8.9	19.9	12.6	4527	9265	6347
Newark	.3	96.9	14,450	-11.1	54.3	18.6	3348	7734	6742
Louisville	35	59.9	5.599	- 7.1	23.8	.7	4302	8560	6124

CITIES	UNITS PER DWELLING by % SINGLE	5 or MORE	DEN-SITY PER MILE	% POP. CHANGE 70-75	% BLACKS	% HISP.	PER CAPITA INCOME AVE.	MED. FAMILY INCOME	MED. BLACK FAMILY INCOME
Long Beach	14.9	69	6,699	- 7.1	5.3	14.0	5652	10277	6745
Tulsa	65	27.2	1,871	.4	10.7	1.7	5173	9866	5066
Oakland	29.4	70.2	6,192	- 8.5	34.5	9.6	5034	9621	6797
Austin	86.4	4.7	3,147	17.7	11.7	18.7	4379	9180	5563
Tucson	43.7	48.4	3,236	10.9	30.6	24.9	4385	8759	6174
Contra Costa Co.	77.2	21.9	795	5	7.5	----	5870	12422	12400
Tampa	65.7	24.9	3,318	.9	19.7	13.3	4362	7677	4881
St. Paul	35.8	62.8	5,355	- 9.8	3.5	2.9	4931	10536	7247
Albuquerque	69.3	25.6	3,150	14.6	2.2	33.8	4544	9636	6439
Birmingham	39.8	54.7	3,345	- 9.7	41.3	.8	4023	7735	5184
Rochester	10.8	81.2	7,280	- 9.4	16.8	5.4	4335	9996	7422
Wichita	33.3	51.5	2,800	- 4.2	9.7	3.5	4951	9519	6065
Akron	32.4	58.3	4,645	- 8.6	17.5	.6	4614	10050	7965
Jersey City	----	100	16,143	- 6.4	21	18.6	4298	9305	7494
St. Petersburg	67.3	30.4	4,178	8.4	14.8	1.8	4940	7357	5240
Richmond	16.5	83.3	3,858	- 6.7	42	1.0	4952	8669	6179
Virginia Beach	70.1	24.7	826	24.3	9.1	2.0	4794	10309	6083

CITIES	UNITS PER DWELLING by % SINGLE	5 or MORE	DEN-SITY PER MILE	% POP. CHANGE 70-75	% BLACKS	% HISP.	PER CAPITA INCOME AVE.	MED. FAMILY INCOME	MED. BLACK FAMILY INCOME
Dayton	100	---	4,893	-15.8	30.4	.9	4091	9600	8615
Anaheim	76.3	23.5	4,499	16.4	.1	----	5191	11801	----
Shreveport	77.4	22.6	2,759	2	34.1	1.3	4086	8478	4467
Fort Wayne	54.2	45	3,351	.2	10.2	2.2	4661	10399	8142
Syracuse	11.5	88.5	7,075	- 7.5	10.8	1.7	4123	9241	6337
Colorado Spr.	97.6	---	2,120	27.8	5	8.5	4336	9036	6116
Santa Ana	66.2	33.1	6,519	13.9	4.3	44.5	4153	10113	7161
Fresno	68	23.2	3,293	5.4	9.5	23.6	4233	8971	5101
Flint	54.1	27	5,295	- 9.9	28.1	2.5	4449	10161	8825
Worcester	3.1	96.3	4,587	- 2.8	1.9	4.3	4435	10038	7120
Salt Lake City	58.9	10.7	2,445	- 3.4	1.2	7.6	4933	8815	6286
Madison	35.3	59.2	3,241	- 2.1	1.5	1.3	4885	11385	7233
Kansas City KS	33.9	57.2	1,522	2.2	19.2	4.9	4220	9162	6588
Arlington VA.	57.4	41.4	5,981	-----	5.8	----	8593	13740	8001
Jackson Miss	66.2	28.4	2,590	2.5	37.6	.7	4514	8296	4541
Anchorage	44.6	38	3,170	27.4	2.2	3.0	6886	13366	9258
Montgomery	98.1	1.1	3,013	9.5	31.9	.9	4253	8462	4107

CITIES	UNITS PER DWELLING by % SINGLE	5 or MORE	DEN-SITY PER MILE	% POP. CHANGE 70-75	% BLACKS	% HISP.	PER CAPITA INCOME AVE.	MED. FAMILY INCOME	MED. BLACK FAMILY INCOME
Tacoma.	38.3	48.9	3,163	- 2	6.8	2.4	4607	9539	8023
Winston-Salem	63	13.8	2,853	8.3	.5	.8	4427	9681	----
Torrance Ca	91.2	1.8	6,818	3.6	.1	8.3	6310	12964	----
Paterson NJ	.6	91.1	16,202	-6	26.9	28.7	3699	8706	7200
Glendale Ca	56.6	40.6	2,383	6.3	3.2	17.8	6316	11651	----
Lansing Mi	59.5	32	3,774	-3.5	9.3	6.3	4614	10839	8168
Peoria	33.5	56.8	3,298	- .8	11.5	1.4	5029	8874	7039
Hamilton Va	97.1	2.9	2,885	3.5	25.4	----	4420	9670	7688
Aurora Co	89.9	1.9	2,228	54.4	1.2	1.4	5146	10553	6889
Fremont Ca	88.9	11.1	1,398	16.8	.4	14.0	5157	12659	----
Stockton Ca	46.4	26.7	3,419	6.9	10.8	22.1	4626	9533	6018
South Bend	50.9	46.8	3,903	-7.7	13.9	2.4	4685	10227	7362
Livona Mi	100	---	3,182	4.3	----	.9	5715	15216	----
Beaumont	89.2	9.2	1,588	-3.3	30.2	3.5	4149	7974	5152
Arlington Tx	75.4	22.2	1,358	22.5	.6	4.1	5018	11529	6800
Cedar Rapids Ia	43.7	54	2,108	-1.5	1.6	.9	4901	10900	7632
Portsmouth Va	100	---	3,747	-2.1	39.9	1.0	4300	8280	6385

APPENDIX B

CITIES	UNITS PER DWELLING by % SINGLE	5 or MORE	DEN-SITY PER MILE	% POP. CHANGE 70-75	% BLACKS	% HISP.	PER CAPITA INCOME AVE.	MED. FAMILY INCOME	MED. BLACK FAMILY INCOME
Allentoen Pa	44.3	35.7	5,990	.5	53.2	5.1	4735	9649	5233
Stamford Ct	47.2	39.9	2,760	-3.4	12.3	5.6	6629	13565	7577
Ann Arbor Mi	100	---	5,339	3.5	6.7	2.1	5562	12819	9504
Trenton NJ	--	100	13,515	-3.3	23.9	3.4	3831	8726	7045
Durham	78.7	14.7	2,550	6.1	38.8	.9	4421	8190	5489
Fall River Ma	96.6	---	3,043	3.6	.5	1.7	3685	8286	---
Davenport Ia	57.4	27.3	1,691	1.5	4.2	2.8	4831	10418	6643
Brockton Ma	100	---	13,842	-.7	2.4	1.6	4189	10377	7667
Racine Wi	49.6	31.9	7,124	- .4	10.5	4.2	4776	10522	7684
Duluth	54.3	25.2	1,396	-6.6	.9	.3	4469	9313	7413
Fullerton Ca	45.9	53.2	4,239	9	.8	13.5	6032	12993	8364
Eugene	57.1	31.8	3,221	14.7	.7	2.1	4677	9995	7412
Quincy Ma	8.3	85.6	5,683	4	.1	----	5057	11094	---
Decatur Il	91.5	8.5	2,683	- .9	10.9	.6	5133	10233	7287
Springfield Il	35	59.5	3,404	-4.7	8.2	----	5143	10338	6579
Sterling Mi	100	---	2,362	41.7	.1	.9	5205	13788	---
Saginaw Mi	54	49.5	4,954	-6.1	24.3	5.4	4216	9990	7662
Burbank Ca	70.6	29.4	5,029	-3.2	.1	----	5915	11501	---

CITIES	UNITS PER DWELLING by % SINGLE	5 or MORE	DEN-SITY PER MILE	% POP. CHANGE 70-75	% BLACKS	% HISP.	PER CAPITA INCOME AVE.	MED. FAMILY INCOME	MED. BLACK FAMILY INCOME
Downey Ca	31	43.7	6,753	-3.1	.1	----	6270	12389	----
Odessa	25.5	73.7	3,420	5.8	5.8	21.5	4341	9377	5140
Tempe Ar	83.4	10.9	2,595	32.3	.7	----	5136	11092	12143
Kenosha Wi	48.4	49.3	5,418	2.4	2.4	2.9	4776	10191	7313
Kalamazoo Mi	14	81	3,233	-7	10	1.5	4542	9849	7424
Somerville Ma	---	100	19,707	-9	.8	----	4278	9594	9400
Salem Or	63	13.9	2,853	8.3	.5	4.5	4427	9581	---
Laredo Tx	99.2	---	3,738	11.6	.5	91.5	4341	4905	---
Taylor Mi	100	---	3,193	9.4	----	----	4570	11977	---
Lawton Ok	86.2	13	2,351	2.6	11.3	5.3	3819	7259	4950
Wilmington De	100	---	5,903	-5.3	43.6	1.6	4235	8050	6252
Pontiac Mi	100	---	3,859	-10.8	26.7	----	3885	9671	8560
Cranston Ri	47.5	45	2,601	.1	38.2	----	5026	10754	7833
Sioux Falls	46	45.1	2,207	.2	.2	.4	4853	9616	---
Daly City Ca	51.6	31.7	10,392	8.7	5.4	----	4645	11858	---
Pawtucket RI	6.4	93.6	8,185	1	.5	2.1	4328	9262	---
Alameda Ca	97.2	---	7,202	1.5	2.6	----	5793	10674	---

APPENDIX B

CITIES	UNITS PER DWELLING by % SINGLE	5 or MORE	DEN-SITY PER MILE	% POP. CHANGE 70-75	% BLACKS	% HISP.	PER CAPITA INCOME AVE.	MED. FAMILY INCOME	MED. BLACK FAMILY INCOME
Valleto Ca	72.4	15	2,230	-1.4	15.5	----	4733	10596	7978
Salinas Ca	64.8	29.1	4,926	19.6	1.5	25.9	4128	10278	6563
Arlington Hts.	80.6	18.3	4,731	7.6	---	----	6874	17031	---
Anderson In	100	---	1,868	-1.9	10.2	.6	4590	9811	7938
Tuscaloosa Al	50.9	8.7	1,641	.4	25	.9	3757	7830	3767
Billings Mt	66.6	19.4	3,876	9.1	.3	2.7	4910	9403	--
Mount Vernon NY	27.3	---	15,741	-7	35.6	----	5138	10966	8873
Lawrence Ma	8.6	85.7	9,910	.7	1.0	4.4	4035	9492	8714
Clearwater Fl	90.3	6.5	3,320	25.3	10.9	----	5552	8329	5385
Waukegan Il	21.1	78.9	3,340	---	12.9	----	5284	11473	8448
Pensacola Fl	97.5	---	2,641	7.8	33.1	1.6	4091	8165	4508
Ventura Ca	69.7	21.7	3,822	9.4	.8	----	5421	11540	5650
Ontario Ca	99.1	---	1,967	-1.5	1.8	----	4023	9617	6087
Midland Tx	62.8	30.3	1,874	5.9	10.8	14.9	4424	10602	5232
Oaklawn Il	46.5	49.5	7,508	3.3	---	----	6089	13824	---
Buena Park Ca	59.2	40.8	6,063	-2.8	.1	----	4849	11865	---
Dubuque Ia	58.9	22.7	3,743	- .9	.2	.5	4479	10454	---
Tyler Tx	69.5	25.2	2,008	2.9	20.5	3.1	4621	8869	5612

CITIES	UNITS PER DWELLING by % SINGLE	5 or MORE	DEN-SITY PER MILE	% POP. CHANGE 70-75	% BLACKS	% HISP.	PER CAPITA INCOME AVE.	MED. FAMILY INCOME	MED. BLACK FAMILY INCOME
Monroe La	80	---	2,676	8.2	38.2	.9	3244	6690	3536
Medford Ma	26.7	60	7,596	-5.6	2.5	----	4680	11145	11771
Galveston Tx	46.8	51.8	2,862	-2.7	29.4	12.0	4256	7997	5151
Portland Me	14.2	15.8	2,277	-8.1	.7	.5	3992	8456	---
Richardson Tx	89.1	1.1	1,783	22.3	---	----	6423	14387	---
Champaign Il	25.2	52	6,083	- .1	9	1.4	4758	11317	5663
Harrisburg Pa	87.8	---	7,668	-14.4	30.7	1.0	4074	8176	6446
Irvington NJ	10	90	20,068	-6.4	3.9	----	4986	10257	8483
Grand Prairie Tx	58.6	41.4	642	11.7	7.3	----	4542	10224	6591
Lancaster Pa	100	---	7.871	-1.8	7.4	2.5	3751	8635	6268
Rochester Mn	79.7	20.3	3,558	4.5	.3	.6	5170	11563	---
Oceanside Ca	72.4	27.3	1,418	38.3	5.1	----	4563	8183	5756
Des Plains Il	37.6	62.4	4,691	-5	.1	----	6115	14056	---
Prova Ut	38	43.8	2,598	4.6	---	2.3	3226	7167	---
Troy Mi	100	---	1,647	40	---	----	6835	14955	---
Vineland NJ	95.3	---	772	13.2	6.5	9.4	4202	9650	5932

SUNBELT AND RAPIDLY GROWING CITIES

APPENDIX C

CITIES	col A	col B	col C	CITIES	col A	col B	col C
New York	0	0	0	Fort Worth	1	0	0
Chicago	0	0	0	Newark	0	0	0
Los Angles	1	1	1	Louisville	1	1	1
Philadelphia	0	0	0	Long Beach	1	1	1
Detroit	0	0	0	Tulsa	1	1	1
Houston	1	1	1	Oakland	1	0	0
Baltimore	0	0	0	Austin	1	1	1
Dallas	1	1	1	Tuscon	1	1	1
Indianapolis	0	1	0	Contra Costa Co.	1	1	1
San Diego	1	1	1	Tampa	1	1	1
San Antonio	1	1	1	St. Paul	0	0	0
Washington, D.C.	0	0	0	Albuquerque	1	1	1
Milwaukee	0	0	0	Birmingham	1	0	0
Phoenix	1	1	1	Rochester	0	0	0
San Francisco	1	0	0	Wichita	1	1	1
Memphis	1	1	1	Akron	0	0	0
Cleveland	0	0	0	Jersey City	0	0	0
Boston	0	0	0	St. Petersburg	1	1	1
Jacksonville	1	1	1	Richmond	1	0	0
New Orleans	1	0	0	Virginia Beach	1	1	1
San Jose	1	1	1	Dayton	0	0	0
Seattle	1	0	0	Anakeim	1	1	1
Denver	0	0	0	Shreveport	1	1	1
Kansas City, Mo.	0	0	0	Fort Wayne	1	0	0
Atlanta	1	0	0	Syracuse	0	0	0
Cincinnatti	0	0	0	Colorado Spr.	1	1	1
Buffalo	0	0	0	Santa Ana	1	1	1
Minneapolis	0	0	0	Fresno	1	1	1
Omaha	0	1	0	Flint	0	0	0
Toledo	0	0	0	Worcester	0	0	0
Oklahoma City	1	1	1	Salt Lake City	1	0	0

SUNBELT AND RAPIDLY GROWING CITIES

APPENDIC C cont.

CITIES	col A	col B	col C	CITIES	col A	col B	col C
Miami	1	1	1	Brockton, Ma.	0	0	0
Madison	0	0	0	Racine Wi.	0	0	0
Kansas City, KS	0	1	0	Duluth	0	0	0
Arlington, Va.	1	1	1	Fullerton, Ca.	1	1	1
Jackson, Miss.	1	1	1	Eugene	1	1	1
Anchorage	1	1	1	Quincy, Ma.	0	0	0
Montgomery	1	1	1	Decatur, Il.	0	0	0
Tacoma	1	0	0	Springfield, Il.	0	0	0
Winston-Salem	1	1	1	Sterling, Mi.	0	1	0
Torrance, Ca.	1	1	1	Saginaw, Mi.	0	0	0
Paterson, N.J.	0	0	0	Burbank, Ca.	1	1	1
Glendale, Ca.	1	1	1	Downey, Ca.	1	0	0
Lansing, Mi.	0	0	0	Odessa	1	1	1
Peoria	0	0	0	Tempe, Ar.	1	1	1
Hamilton. Va.	1	1	1	Kenosha, Wi.	0	0	0
Aurora, Co.	1	1	1	Kalamozoo, Mi.	0	0	0
Fremont, Ca.	1	1	1	Somerville, Ma.	0	0	0
Stockton, Ca.	1	1	1	Salem, Or.	1	1	1
South Bemd	0	0	0	Laredo, Tx.	1	1	1
Livona, Mi.	0	1	0	Taylor, Mi.	0	1	0
Beaumont	1	0	0	Lawton, Ok.	1	1	1
Arlington, Tx.	1	1	1	Wilmington, De.	0	0	0
Cedar Rapids, Il.	0	0	0	Pontiac, Mi.	0	0	0
Portsmouth, Va.	1	0	0	Cranston, R.I.	0	0	0
Allantown, Pa.	0	0	0	Sioux Falls	0	0	0
Stanford, Ct.	0	0	0	Daly City, Ca.	1	1	1
Ann Arbor, Mi.	0	1	0	Pawtucket, R.I.	0	0	0
Trenton, N.J.	0	0	0	Alamedo, Ca.	1	1	1
Durham	0	1	1	Valleto, Ca.	1	1	1
Fall River, Ma.	0	0	0	Salinas, Ca.	1	1	1
Davenport, Ia.	0	0	0	Arlington Hts.	1	1	1

SUNBELT AND RAPIDLY GROWING CITIES

APPENDIX C cont.

CITIES	col. A	col. B	col. C	CITIES	col. A	col. B	col. C
Anderson, In.	0	0	0	Medford, Ma.	0	0	0
Tuscaloosa, Al.	1	0	0	Galveston, Tx.	1	0	0
Billings, Mt.	0	1	0	Portland, Me.	0	0	0
Mount Vernon, NY	0	0	0	Richardson, Tx.	1	1	1
Lawrence, Ma.	0	0	0	Champaign, Il.	0	0	0
Clearwater, Fl.	1	1	1	Harrisburg, Pa.	0	0	0
Waukegan, Il.	0	0	0	Irvington, N.J.	0	0	0
Pensacola, Fl.	1	1	1	Grand Prairie	1	1	1
Ventura, Ca.	1	1	1	Lancaster, Pa.	0	0	0
Ontario, Ca.	1	0	0	Rochester, Mn.	0	1	0
Midland, Tx.	1	1	1	Oceanside, Ca.	1	1	1
Oaklawn, Il.	0	1	0	Des Plains, Il.	0	0	0
Buena Park, Ca.	1	0	0	Prova, Ut.	1	1	1
Dubuque, Ia.	0	0	0	Troy, Mi.	0	1	0
Tyler, Tx.	1	1	1	Vineland, N.J.	0	1	0
Monroe, La.	1	1	1				

Column A. Number 1 represents the sunbelt cities. For the purposes of this report, the sunbelt cities are those located south of the Mason-Dixon Line, to the Mississippi-Arkansas River line, to the Rocky Mountains and north to Canada; (as shown in the Hammond Medallion World Atlas, 1970, pp. 188 - 189).

Column B. Number 1 represents those cities that are rapidly growing cities; (as depicted in The World Almanac & Book of Facts 1977, "How Cities Grew 1790 to 1973).

Column C. Number 1 represents rapidly growing sunbelt cities.

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