"Introduction to Fire Prevention".

In Section 1 of this course you will cover these topics:

- History And Philosophy Of Fire Prevention
- Status Of Education, Engineering, And Enforcement In Usa
- Public Fire And Life Safety Education Programs

Topic Objective:

At the end of this topic student will able to learn:

- Fire Fighting
- History
- Fog nozzle
- Deluge Gun
- Roles
- Variations
- Pattern
- Model building
- Hazardous Materials Appliances
- Logistical Support Appliances
- Passive visual warnings
- Active visual warnings
- Audible warnings
- Additional equipment
- Campbell Shopping Complex fire inferno
- Sawtooth Complex fire

Definition/Overview:

Fire Prevention: Fire protection is the safety and of the hazards associated with fires. It involves the study of the behaviour, compartmentalisation, suppression and investigation of fire and its related emergencies as well as the research and development, production, testing

and application of mitigating systems. In structures, be they land-based, offshore or even ships, the owners and operators are responsible to maintain their facilities in accordance with a design-basis that is rooted in laws, including the local building code and fire code, which are enforced by the Authority Having Jurisdiction.

Fire Fighting: Essentials of Fire Fighting is a fire service training manual produced by Fire Protection Publications (FPP) and the International Fire Service Training Association (IFSTA). Fire Protection Publications is a department of the College of Engineering, Architecture, and Technology (CEAT) a division within Oklahoma State University (OSU), in Stillwater, Oklahoma. This manual is used by fire service training agencies and departments around the world to train personnel to become firefighters. The Essentials of Fire Fighting is the required training manual used in countless local fire departments and state/provincial training agencies in every region of the United States and Canada. The manual is currently in its fourth edition with a fifth edition under production at the time this article was written.

Model building: Model building codes require passive fire protection and active fire protection systems to minimize damage resulting from a fire. The most common form of active fire protection is fire sprinklers. To maximize passive fire protection of buildings, building materials and furnishings in most developed countries are tested for fire-resistance, combustibility and flammability. Upholstery, carpeting and plastics used in vehicles and vessels are also tested.

Key Points:

1. History

In 1934, the Western Actuarial Bureau sponsored a meeting in Kansas City to begin the process of gaining consensus on common training methods and techniques. State fire training directors from Oklahoma, Kansas, Missouri, and Arkansasattended and the Fire Service Training Association (FSTA) was formed. By its next meeting in 1935, 16 states were represented and more joined every year there after. Oklahoma A&M College (OAMC) was chosen to publish the manuals to be developed by the Fire Service Training Association. In 1935, two planographed, hardbound books were produced: Elementary Science Applied to the Firefighting Service and Ladders. Eventually a total of ten topics were covered and

published in 1937. Because of their red covers, the fire service called them The Redbooks. The ten original Redbooks were:

- Forcible Entry, Ropes, Knots, and Extinguishers
- Ground Ladders
- Hose
- Salvage and Overhaul
- Fire Streams
- Fire Apparatus
- Ventilation
- Rescue
- First Aid
- Fire Prevention and Inspection

In 1955, FSTA becomes the International Fire Service Training Association or IFSTA when the first Canadian officials attend and participate. In 1957, OklahomaA&M Collegebecame Oklahoma State University. Throughout the 1950s and 1960s IFSTA became more active in the U.S.fire service. IFSTA was a participant in the Williamsburg meeting that led to the formation of the Joint Council of National Fire Service Organizations. Everett Hudiburg, director of IFSTA, was selected to chair the Joint Council and spearheaded the formation of the National Professional Qualifications Board (Pro Board). The Pro Board developed professional qualifications standards and a national certification system. The four original professional qualifications standards adopted in 1974 included:

- Fire Fighters
- Fire Officers
- Fire Inspectors and Investigators
- Fire Instructors

IFSTA realized that its products could be used to assist firefighters in achieving certification. IFSTA manuals were then revised to ensure they covered the standards. It was apparent that it would be impractical for firefighters to have to buy at least 10 manuals to meet the firefighter certification requirements.

It was decided that a single manual should be developed to assist firefighters in achieving certification, and thus the Essentials of Fire Fighting was born. Carroll Herring, director of the Louisiana Fireman Training Program (now know as the Louisiana State University Fire and Emergency Training Institute, is credited with recommending the title of Essentials of Fire Fighting. The first edition of Essentials of Fire Fighting was published in 1977 and subsequent editions have been published in 1983, 1992, and 1998. The next edition is scheduled for publication in 2007. It has been published, and is much better then the old one. Instead of teaching you stupid things like how to use a 2.2 SCBA, it actullyhas Jakes in Black FDNY gear being all badass.

2. Fog nozzle

A fog nozzle is a firefighting hose nozzle that breaks the water that flows through it into tiny droplets of water. The theory is that small droplets of water create more surface area than a solid stream created by a smooth bore nozzle. The water absorbs the heat, turns into steam, and displaces the oxygen, smothering the fire. With the increase of surface area, this job is done quicker. Specially designed fog nozzles (with no stream adjustment) have been certified by Underwriters Laboratories (UL) for use on Class B & C hazards.

3. Deluge Gun

A deluge gun, fire monitor, master stream, or deck gun is an aimable controllable high-capacity water jet used for manual firefighting or automatic fire protection systems. Fire monitors are often designed to accommodate foam which has been injected in the upstream piping. Fire monitors are often fitted to fire boats and on top of large firetrucks for use in manual fire fighting efforts. Fire monitors are also used in fixed fire protection systems to protect high hazards, such as aviation hangars and helicopter landing pads. Most apparatus-mounted fire monitors can be directed by a single firefighter, compared to a standard fire hose which normally requires several. Fire Monitors can also be automatically positioned for fixed systems. They can pump up to, and sometimes over, 2000 gallons per minute (126 litres per second).

4. Roles

Fog nozzles play an important part in firefighting tactics. These types of nozzles are very versatile and can accommodate different sizes of fire hose and fire streams. They can be used for protection and for fire attack. When given the appropriate nozzle pressure and water supply, they are effective for any fire ground situation.

Fog nozzles are typically used with fire attack hand lines. Most hand lines are 1 1/2, 1 3/4, and 2 1/2 diameter fire hose. The fog nozzle that will be used on each size of fire hose is made to handle the maximum gallons per minute (GPM) rating that the fire hose can handle. There are fog nozzles that are used with master stream appliances also. A master stream can flow between 350gpm to 2000gpm. The fog nozzles placed on these types of appliances are made to handle that high of flow rate. Even with that high of flow rate, these fog nozzles are still made with spray pattern adjustments and in the automatic or manually adjustable styles.

5. Variations

Fog nozzles are made in different styles and sizes. The two styles to choose from are the automatic fog nozzles and the manually adjustable fog nozzles. Both of these nozzles can be adjusted for the gallons per minute a firefighter needs to do the job. The automatic fog nozzle relies on a constant pressure at the nozzle. The firefighter can operate the open-close handle, and the nozzle will adjust the rate of flow by itself. This will give the firefighter the best flow rate with the given amount of water. The manually adjustable fog nozzle works differently. On these types of nozzles there is a flow adjustment bezel around the tip of nozzle. Usually the 60gpm (gallons per minute), 95gpm, and the 125gpm flow rate selection settings are on the bezel; depending on the size of the nozzle. The firefighter can select one of these settings before or after the nozzle is opened. Once one of these gallon settings has been selected and supplied with the appropriate pressure, the flow rate will remain consistent with the gallons per minute selected.

6. Pattern

All styles of fog nozzles have a spray pattern adjustment. These nozzles can produce three different types of streams; the straight stream, the narrow-angle cone, and the wide-angle cone. Each of these types of streams is used for different purposes. The straight stream can be

used for long reach. The narrow-angle cone can be used for advancing an attack line into a structure or the fire room. Protection and ventilation is the typical use of the wide-angle fog pattern. These types of spray patterns assist the firefighter in accomplishing his or her fire suppression efforts.

7. Hazardous Materials Appliances

Some fire departments keep special appliances for dealing with hazardous materials, or "HazMat". These are of several types, from those used to clean spilled oil on streets and highways, to full decontamination units, designed to clean victims and rescuers of contaminants after an incident.

8. Logistical Support Appliances

Many fire departments operate a number of vehicles in specialised logistical functions. These can be stand alone vehicles, or may be modular, such as with the use of a 'hookloader' system

Sometimes hookloadersare used for seldom-used equipment. A hookloader can load a container very rapidly and act as a special unit with lower investment costs. For example, the Helsinki Rescue Department in Finland has several hookloader trucks and more than 40 containers including a water container, a hose container, an oil destruction container. Containers may also carry a command post, material for catastrophes, hoses and pumps for forest fires, even field hospitals, or for example, high-power pumps.

9. Design and construction

Many fire appliances around the world are based on standard truck or lorry models, which are upgraded to the specifications required by the purchasing department. In the United States, a majority of fire trucks are specially designed from the chassis to the cab and body. This has led to the use of the term custom fire truck, as opposed to a commercial chassis and cab.

Modifications a fire appliance might undergo include adjustments for higher durability, removal of any speed limiter, and adjustments for long periods of idling at a higher temperature. This may be accomplished by heavy duty suspensions, brakes, tires, alternator, transmission and cooling systems. It is also usual to upgrade the capacity of the electrics of the vehicle, in order to accommodate the use of additional electrical and electronic

equipment. Fire appliances have audible and visual warnings, to protect themselves from traffic, and make themselves seen to other units at an incident. In many countries, use of the audible and visual warnings affords the driver a degree of exemption from road traffic laws (such as the right to exceed speed limits, treat red stop lights as give way etc.) and may also infer a duty on other motorists to move out of the direction of passage of the fire vehicle (or face possible prosecution).

10. Visual warnings

Visual warnings on a fire appliance can be of two types - either passive or active.

11. Passive visual warnings

The passive visual warnings involve the use of high contrast patterns. Older vehicles (and those in developing countries) are more likely to have their patterns painted on, whereas modern appliances often carry retro-reflective designs which reflect light from car headlights or torches. Patterns include 'checker board' (alternate coloured squares, sometimes called 'battenburgmarkings', named after a type of cake), chevrons (arrowheads - often pointed towards the front of the vehicle if on the side, or pointing vertically upwards if on the rear) or stripes (along the side - these were the first type or retro-reflective devices introduced, as the original retro-reflective material came only in tape form). In some countries, in addition to retro-reflective markings, vehicles are now painted a bright yellow or orange, although in many other countries, red remains the colour for fire engines.

Another passive marking is the word FIRE, RESCUE or local language variant spelled out in reverse on the front of the vehicle. This enables drivers of other vehicles to more easily identify an approaching fire service vehicle in their rear view mirrors. The appliance may also display a telephone number which may be used to summon assistance, along with the name of the operating department or station identifier.

12. Active visual warnings

The active visual warnings are usually in the form of flashing coloured lights (also known as 'beacons' or 'lightbars'). These flash in order to attract the attention of other road users as the fire appliance approaches, or to provide warning to motorists approaching a stopped appliance in a dangerous position on the road. Common coloursfor fire warning beacons are

blue and red. The beacons can be made to flash, the original method was to place a spinning mirror which moves around a light bulb, called a 'rotating beacon'. More modern methods include the use of strobe lights, which are usually brighter, and can be programmed to produce specific patterns (such as a left -> right pattern when parked on the left hand side of the road, indicating to other road users that they should move out away from the vehicle). There is also the more widespread use of LED flashing lights as they are low profile and low energy.

13. Audible warnings

In addition to visual warnings, most appliances are also fitted with audible warnings, sometimes known as sirens, which can alert people and vehicles to the presence of an emergency vehicle before they can be seen. The first audible warnings were mechanical bells, mounted to either the front or roof of the truck. Most vehicles are now fitted with electronic sirens, which can produce a range of different noises. Fire service driving training often includes the use of different noises depending on traffic conditions and manoeuvre being performed. For instance, on a clear road, approaching a junction, the 'wail' setting may be used, which gives a long up and down variation, with an unbroken tone, whereas, in heavy slow traffic, a 'yelp' setting may be preferred, which is like a wail, but sped up. The speakers for modern sirens can be located in several places on the vehicle, including being integral to the lightbar, or hidden in the grille. Some vehicles may also be fitted with airhorn audible warnings. A number of North American fire departments have returned to the 'acoustic' or 'air' traditional siren as its overtones help the public 'locate' and avoid the firetruck--the newer electronic signals disperse almost pure tones which are hard to locate, especially in city 'canyons' of buildings.

A development is the use of the RDS system of car radios, whereby the vehicle can be fitted with a short range FM transmitter, set to RDS code 31, which interrupts the radio of all cars within range, in the manner of a traffic broadcast, but in such a way that the user of the receiving radio is unable to opt out of the message (as with traffic broadcasts). This feature is built in to all RDS radios for use in national emergency broadcast systems, but short range units on emergency vehicles can prove an effective means of alerting traffic to their presence, although is not able to alert pedestrians and non-RDS radio users.

14. Additional equipment

Firefighters may also have a range of additional equipment available to them, which may include:

- Two Way Radio - One of the most important pieces of equipment. Many services have moved from traditional UHF/VHF sets, which can be monitored externally, to more secure systems, such as those working on a GSM system, such as TETRA
- Mobile Data Terminal - Many appliances are fitted with Mobile Data Terminals (or MDTs), which are connected wirelessly to a central computer, and enable firefighters to call up details such as incident logs, maps of locations or exclusion zones.
- Evidence gathering CCTV - Some fire vehicles can be fitted with video cameras used to record activity. They may also be fitted with sound recording facilities. This is used for the protection of the crew (and evidence of any assaults or intimidation of the firefighters) or can be used as evidence relating to the incident itself.
- Ramming pads - These rubberised pads are fitted to the chassis of the appliance, to allow the vehicle to be used as a battering ram, or to push other vehicles off the road in an emergency.

15. CampbellShopping Complex fire inferno

The Campbell Shopping Complex fire was a major disaster in Malaysiawhich took place on 8 April 1976 at Jalan Campbell (now Jalan Dang Wangi), Kuala Lumpur. The entire shopping complex including its 20 storey office tower block were completely destroyed in a fire. It was Malaysia's first towering inferno and the worst fire disaster involving a highrise building to date. The fire, which started at 10.30 pm, lasted for nearly 30 hours, claiming the life of one victim, Yap Leong Hoem, 59, as well as the total losses of RM50 million. The cause of the fire was an electrical short circuit.

The building was burnt for nearly 30 hours and fortunately, it did not collapse entirely as one section of the podium had collapsed due to the intense heat. The building was only three years old at the time of the blaze, having being opened in 1973 which was at that time Kuala Lumpur's first highrise shopping complex. It was kept under repair and reconstructed for a few years after the blaze before it was reopened to the public around 1979.

16. Sawtooth Complex fire

The SawtoothComplex fire was a group of wildfires in San Bernardino County in the U.S. state of California in the summer of 2006. The Complex was made up of the Sawtooth, Waters, and Ridge fires, and burnt in chaparral two miles (3.2 km) east of Yucca Valley.

The SawtoothComplex fire was started by lightning on July 9, 2006 at 8:30 am PDT. The fire burned 61,700 acres (250 km) and destroyed 50 homes, 8 mobile homes, 13 garages, 171 outbuildings, 191 cars and pick up trucks, 3 R.V.s, 27 trailers, 2 railcars, 9 tractors. 12 residences were damaged. There were 17 minor injuries and 1 civilian fatality.

Residents of Pioneertown, Skyline Ranch, Pipes Canyon, Gamma Gulch, northern MorongoValley, Burns Canyonand Rimrock were placed under mandatory evacuations. Pioneertown is the site of several historic structures dating back to 1940s Hollywood film production. While some buildings in Pioneertown were destroyed, the historic structures were spared. At 5:00 pm PDT on July 14, the Sawtooth Complex fire merged with the Millard Complex fire. The fire was 100% contained on July 18

Topic Objective:

- Fire protection engineering
- Education
- Professional registration
- Fog nozzle
- Deluge Gun
- Roles
- Variations
- Pattern
- Goals of firefighting
- Prevention
- Self-preservation
- Occupational health and safety
- Rescue operations
- Communication and command structure
- Structure fires

Definition/Overview:

Fire protection engineering: Fire protection engineering(also known as fire engineeringor fire safety engineering) is the application of science and engineering principles to protect people and their environments from the destructive effects of fire and smoke.

Key Points:

1. Fire protection engineering

In practice, fire protection engineers typically identify risks and design safeguards that aid in preventing, controlling, and mitigating the effects of fires. Fire protection engineers assist architects in evaluating buildings' life safety and property protection goals. FPEs are also employed as fire investigators, including such very large-scale cases as the analysis of the collapse of the World Trade Centers. NASA uses fire protection engineers in its space program to help improve safety.

2. History

Fire protection engineering (FPE) can lay a claim to roots dating as far back as Ancient Rome, when the Emperor Nero ordered the city to be rebuilt utilizing passive fire protection methods, such as space separation and non-combustible building materials, after a catastrophic fire. The discipline of fire protection engineering emerged in the early 20th century as a distinct discipline, separate from civil, mechanical and chemical engineering, in response to new fire problems posed by the Industrial Revolution. Fire protection engineers of this era concerned themselves with devising methods to protect large factories, particularly spinning mills and other manufacturing properties. Another motivation to organize the discipline, define practices and conduct research to support innovations became clear in response to catastrophic conflagrations and mass urban fires that swept many major cities during the latter half of the 19th century.

In 1903 the first degree program in fire protection engineering was initiated as the Armour Institute of Technology (later becoming part of the Illinois Institute of Technology).

As the 20th Century emerged, several catastrophic fires resulted in changes to buildings codes to better protect people and property from fire. It was only in the latter half of the 20th Century that fire protection engineering emerged as a unique engineering profession. The primary reason for this emergence was the development of the body of knowledge, specific to the profession that occurred after 1950. Other factors contributing to the growth of the profession include the start of the Society of Fire Protection Engineers in 1950, the

emergence of independent consulting fire protection engineers, and the promulgation of engineering standards for fire protection.

3. Education

Fire protection engineers, like their counterparts in other engineering and scientific disciplines, undertake a formal course of education and continuing professional development to acquire and maintain their competence. This education typically includes foundation studies in mathematics, physics, chemistry, and technical writing. Professional engineering studies focus students on acquiring proficiency in material science, statics, dynamics, thermodynamics, fluid dynamics, heat transfer, engineering economics, ethics, Systems in engineering, reliability, and environmental psychology. Specialized studies in combustion, probabilistic risk assessment or risk management, the design of fire suppression systems, the application and interpretation of model building codes, and the measurement and simulation of fire phenomena complete most curricula.

In the United States, the University of Maryland (UMD) offers the only ABET-accredited B.S. degree program in Fire Protection Engineering, as well as graduate degrees and a distance M.Eng. program. Worcester Polytechnic Institute (WPI) offers a M.S. and a Ph.D. in Fire Protection Engineering. Oklahoma State Universityoffers a B.S. in Fire Protection and Safety Technology. Other institutions, such as the University of Kansas, Illinois Institute of Technology, University of California,Berkeley, and University of HoustonDowntownhave offered courses in Fire Protection Engineering or technology.

In Europe, the University of Edinburgh has been among the first universities to offer a degree in Fire Engineering and had its first research group in fire in the 1970's (these activities are now conducted at the new BRE Centre for Fire Safety Engineering). Other European Universities active in the fire engineering are Lund University, Stord/HaugesundUniversity College, University of Central Lancashire, Universityof Manchester, Universityof Ulster, Universityof Leeds, Universityof Greenwich and London SouthBank University.

4. Professional registration

Suitably qualified and experienced fire protection engineers may qualify for registration as a professional engineer. The recognition of fire protection engineering as a separate discipline varies from state to state in the United States. Few countries outside the United Statesregulate the professional practice of fire protection engineering as a discipline, although they may restrict the use of the title engineer in association with its practice.

The titles fire engineer and fire safety engineer tend to be preferred outside the United States, especially in the United Kingdom and Commonwealth countries influenced by the British fire

service. Some proponents of the title fire safety engineer assert that the title fire protection engineersuggests a concern only with the design of active fire protection systems, such as automatic fire sprinklers, fire detection, fire alarm systems, smoke management systems, gaseous fire suppression and other special hazard systems. The advocates of the title fire safety engineer suggest it more accurately indicates an interest in both preventive and protective measures. Those who prefer the title fire engineer suggest that it encompasses a broader range of professional activities associated with fire risk management, including the management of fire services. All titles are widely recognised. The Institution of Fire Engineers is one international organization that qualifies many aspects of the training and qualifications of fire engineers.

5. Fog nozzle

A fog nozzle is a firefighting hose nozzle that breaks the water that flows through it into tiny droplets of water. The theory is that small droplets of water create more surface area than a solid stream created by a smooth bore nozzle. The water absorbs the heat, turns into steam, and displaces the oxygen, smothering the fire. With the increase of surface area, this job is done quicker. Specially designed fog nozzles (with no stream adjustment) have been certified by Underwriters Laboratories (UL) for use on Class B & C hazards.

6. Deluge Gun

A deluge gun, fire monitor, master stream, or deck gun is an aimable controllable high-capacity water jet used for manual firefighting or automatic fire protection systems. Fire monitors are often designed to accommodate foam which has been injected in the upstream piping. Fire monitors are often fitted to fire boats and on top of large firetrucks for use in manual fire fighting efforts. Fire monitors are also used in fixed fire protection systems to protect high hazards, such as aviation hangars and helicopter landing pads. Most apparatus-mounted fire monitors can be directed by a single firefighter, compared to a standard fire hose which normally requires several. Fire Monitors can also be automatically positioned for fixed systems. They can pump up to, and sometimes over, 2000 gallons per minute (126 litres per second).

7. Roles

Fog nozzles play an important part in firefighting tactics. These types of nozzles are very versatile and can accommodate different sizes of fire hose and fire streams. They can be used for protection and for fire attack. When given the appropriate nozzle pressure and water supply, they are effective for any fire ground situation.

Fog nozzles are typically used with fire attack hand lines. Most hand lines are 1 1/2, 1 3/4, and 2 1/2 diameter fire hose. The fog nozzle that will be used on each size of fire hose is made to handle the maximum gallons per minute (GPM) rating that the fire hose can handle. There are fog nozzles that are used with master stream appliances also. A master stream can flow between 350gpm to 2000gpm. The fog nozzles placed on these types of appliances are made to handle that high of flow rate. Even with that high of flow rate, these fog nozzles are still made with spray pattern adjustments and in the automatic or manually adjustable styles.

8. Variations

Fog nozzles are made in different styles and sizes. The two styles to choose from are the automatic fog nozzles and the manually adjustable fog nozzles. Both of these nozzles can be adjusted for the gallons per minute a firefighter needs to do the job. The automatic fog nozzle relies on a constant pressure at the nozzle. The firefighter can operate the open-close handle, and the nozzle will adjust the rate of flow by itself. This will give the firefighter the best flow rate with the given amount of water. The manually adjustable fog nozzle works differently. On these types of nozzles there is a flow adjustment bezel around the tip of nozzle. Usually the 60gpm (gallons per minute), 95gpm, and the 125gpm flow rate selection settings are on the bezel; depending on the size of the nozzle. The firefighter can select one of these settings before or after the nozzle is opened. Once one of these gallon settings has been selected and supplied with the appropriate pressure, the flow rate will remain consistent with the gallons per minute selected.

9. Pattern

All styles of fog nozzles have a spray pattern adjustment. These nozzles can produce three different types of streams; the straight stream, the narrow-angle cone, and the wide-angle cone. Each of these types of streams is used for different purposes. The straight stream can be

used for long reach. The narrow-angle cone can be used for advancing an attack line into a structure or the fire room. Protection and ventilation is the typical use of the wide-angle fog pattern. These types of spray patterns assist the firefighter in accomplishing his or her fire suppression efforts.

10. Goals of firefighting

Aside from the main task of extinguishing fires, the goals of firefighting are (in order) saving lives, saving property, and protecting the environment. Firefighting is an inherently difficult occupation. As such, the skills required for safe operations are regularly practiced during training evolutions throughout a firefighters career. In the United States, the preeminent fire training and standards organization is the National Fire Protection Association (NFPA). Often initial firefighting skills are taught during a local, regional, or state approved fire academy. Depending on the requirements of a department, additional skills and certifications such as technical rescue and Para-medicine may also be taught at this time.

Firefighters work closely with other emergency response agencies, most particularly local and state police departments. As every fire scene is technically a crime scene until deemed otherwise by a qualified investigator, there is often overlap between the responsibilities of responding firefighters and police officers such as evidence and scene protection, initial observations of first respondents, and chain of evidence issues. The increasing role of firefighters in providing emergency medical services also brings firefighters into common overlap with law enforcement. One example of this is a common state law requiring all gunshot wounds to be reported to law enforcement agencies. Most career (full time, paid) firefighters in North America are represented by the International Association of Fire Fighters.

Fire fighting has several basic skills: prevention, self preservation, rescue, preservation of property and fire control. Firefighting is further broken down into skills which include size-up, extinguishing, ventilation, and salvage and overhaul. Search and Rescue, which has already been mentioned, is performed early in any fire scenario and many times is in unison with extinguishing and ventilation.

11. Prevention

Prevention attempts to ensure that no place simultaneously has sufficient heat, fuel and air to allow ignition and combustion. Fernando Cardona, the leading researcher in fire prevention is accredited with much of the advancement and improvement to modern fire fighting technique. Most prevention programs are directed at controlling the energy of activation (heat).

Fire suppression systems have a proven record for controlling and extinguishing unwanted fires. Many fire officials recommend that every building, including residences, have fire sprinkler systems. Correctly working sprinklers in a residence greatly reduce the risk of death from a fire. With the small rooms typical of a residence, one or two sprinklers can cover most rooms. In addition, a major duty of fire services is the regular inspection of buildings to ensure they are up to the current building fire codes, which are enforced so that a building can sufficiently resist fire spread, potential hazards are located, and to ensure that occupants can be safely evacuated, commensurate with the risks involved.

Other methods of fire prevention are by directing efforts to reduce known hazardous conditions or by preventing dangerous acts before tragedy strikes. This is normally accomplished in many innovative ways such as conducting presentations, distributing safety brochures, providing news articles, writing public safety announcements(PSAs) or establishing meaningful displays in well-visited areas. Ensuring that each household has working smoke alarms, is educated in the proper techniques of fire safety, has an evacuation route and rendezvous point is of top priority in public education for most fire prevention teams in almost all fire department localities.

12. Self-preservation

Self-preservation is very critical. The basic technique firefighters use is to know where they are, and to avoid hazards. Current standards in the United States recommend that firefighters work in teams, using a "two-in, two-out" rule whenever in an IDLH (Immediately Dangerous to Life or Health) environment.

Tools are generally carried at all times and are important for not only forcible entry but also for self rescue. A Self Contained Breathing Apparatus (SCBA) delivers air to the firefighter

through a full face mask and is worn to protect against smoke inhalation, toxic fumes, and super heated gasses. A special device called a Personal Alert Safety System (PASS) is commonly worn independently or as a part of the SCBA to alert others when a firefighter stops moving for a specified period of time or manually operates the device. The PASS device sounds an alarm that can assist another firefighter (Firefighter Assist and Search Team), in locating the firefighter in distress.

Firefighters often carry personal self rescue ropes. The ropes are generally 30 feet long and can provide a firefighter (that has enough time to deploy the rope) a partially controlled exit out an elevated window. Lack of a personal rescue rope is cited in the deaths of two New York City Firefighters, Lt. John Bellewand Lt. Curtis Meyran, who died after they jumped from a fourth floor of a burning apartment building in the Bronx. Of the four firefighters who jumped and survived only one of them had a self rescue rope. Since the incident the Fire Department of New York City has issued self rescue ropes to their firefighters. In the United States, 25% of fatalities to firefighters are caused by vehicle accidents while responding to or returning from an incident. Many firefighters are also injured or killed by vehicles while working at an incident (Paulison 2005). However, a large percentage of firefighters also succumb to heart disease, in the line of duty.

13. Occupational health and safety

13.1. Cardiovascular disease

Firefighting has long been associated with poor cardiovascular outcomes. In the United States, the most common cause of on-duty fatalities for firefighters is sudden cardiac death. In addition to personal factors that may predispose an individual to coronary artery disease or other cardiovascular diseases, occupational exposures can significantly increase a firefighter's risk. For instance, carbon monoxide, present in nearly all fire environments, and hydrogen cyanide, formed during the combustion of paper, cotton, plastics, and other substances containing carbon and nitrogen, interfere with the transport of oxygen in the body. Hypoxia can then lead to heart injury. In addition, chronic exposure to particulate matter in smoke is associated with atherosclerosis. Noise exposures may contribute to hypertension and possibly ischemic heart disease. Other factors associated with firefighting, such as stress, heat stress, and heavy physical exertion, also increase the risk of cardiovascular events.

13.2. Structural collapses

Another leading cause of death during firefighting is structural collapse of part of a burning building (e.g. a wall, floor, ceiling, roof, or truss system). Structural collapse, which often occurs without warning, may crush or trap on-duty firefighters. To avoid loss of life, all on-duty firefighters should maintain two-way communication with the incident commander and be equipped with a Personal Alert Safety System device (PASS).

13.3. Rescue

Rescue operations consist of searching for and removing trapped occupants of hazardous conditions. Animals may also be recovered, if resources and conditions permit. Generally triage and first aid are performed outside, as removal from the hazardous atmosphere is the primary goal in preserving life. Search patterns include movement against room walls (to prevent rescuers from becoming lost or disoriented) and methodical searches of specific areas by designated teams. Unlike a fire control team, a rescue team typically moves faster, but has no hose to follow out to safety through the smoky darkness. A rescue rope may be needed for tethering a team involved in exceptionally dangerous conditions.

13.4. Incident commanders

Incident commanders also arrange for standby search and rescue teams to assist if firefighters become lost, trapped, or injured. Such teams are commonly, and often interchangeably, known as Rapid Intervention Teams (RIT), or Firefighter Assist and Search Teams (FAST). According to "two-in, two-out", the only time it is permissible for a team of firefighters to enter a burning structure without backup in place outside is when they are operating in what is known as "Rescue Mode". Rescue Mode occurs when firefighters have arrived at the scene, and it is readily apparent that there are occupants trapped inside who need immediate rescue. At such a time, properly equipped firefighters (exercising good judgment tempered by training and experience) may enter the structure and proceed directly to victims in need of rescue, RIT will then be put in place when resources permit. The Worcester Cold Storage Warehouse fire provides a stark example of disoriented rescuers perishing when their air supply was exhausted during a fruitless primary search and subsequent RIT searches.

Searches for trapped victims are exhaustively detailed, often including searches of cupboards, closets, and under beds. The search is divided into two stages, the primary and secondary. The primary search is conducted quickly and thoroughly, typically beginning in the area closest to the fire as it is subjected to the highest risk of exposure. The secondary search only begins once the fire is under control, and is always (resources and personnel permitting) performed by a different team from that which did the primary search.

14. Rescue operations

Rescue operations may also involve the extrication of victims of motor vehicle crashes (abbreviated MVC). Here firefighters use spreaders, cutters, and hydraulic rams, collectively called hydraulic rescue toolsknown better to the public as Jaws of Lifeto remove metal from the patient, followed by actually removing the patient, usually on a backboard with collar, and transferring to a waiting ambulance crew in the cold zone. More technical forms of rescue include subsets such as rope rescue, swiftwater rescue, confined space rescue, and trench rescue. These types of rescue are often extremely hazardous and physically demanding. They also require extensive technical training. NFPA regulation 1006 and 1670 state that a "rescuer" must have medical training to perform any technical rescue operation. Accordingly, firefighters involved in rescue operations have some kind of medical training as first responders, emergency medical technicians, paramedics or nurses.

Searching a building is normally a two to three man team. The most common way to search a building that is filled with smoke is to crawl on hands and knees with an axe (or any other tool) in the firefighter's left hand. The firefighter will keep one hand on the wall, or a foot in contact at all times with the wall. And scoot himself forward, swinging the handle of the axe back and forth, searching for any objects in his way. If the object moves when touched, it might be a person. Depending on the sound/feel it gives back, he can check what ever the object was. If it's not a person, he will continue down along the wall.

Meanwhile his buddy/buddies have their right hand in contact with the lead firefighter's left ankle and scooting with them. This way they cover a far larger spread of ground. Once the person(s) is found, they will drag, carry, push, any way possible really, they will move the victim back the way they came because they know the way they went was safe.

It is also important to remember that the Firefighter needs to check the floor before he moves into the room. Once going into the room, he will go right, and follow the right wall. ALWAYS. Next, when in a group of 3, the 2nd in the search line will go into most rooms, check it over, and then return out. (This is when doing a very detailed search because location of the victim is unknown)

15. Communication and command structure

The expedient and accurate handling of fire alarms or calls are significant factors in the successful outcome of any incident. Fire department communications play a critical role in that successful outcome. Fire department communications include the methods by which the public can notify the communications center of an emergency, the methods by which the center can notify the proper fire fighting forces, and the methods by which information is exchanged at the scene. A telecommunicator(often referred to as a dispatcher) has a role different but just as important as other emergency personnel. The telecommunicatormust process calls from unknown and unseen individuals, usually calling under stressful conditions. He/she must be able to obtain complete, reliable information from the caller and prioritize requests for assistance. It is the dispatcher's responsibility to bring order to chaos.

While some fire departments are large enough to utilize their own telecommunication dispatcher, most rural and small areas rely on a central dispatcher to provide handling of fire, rescue and police services. Firefighters are trained to use communications equipment to receive alarms, give and receive commands, request assistance, and report on conditions. Since firefighters from different agencies routinely provide mutual aid to each other, and routinely operate at incidents where other emergency services are present, it is essential to have structures in place to establish a unified chain of command, and share information between agencies. The U.S. Federal Emergency Management Agency has established a National Incident Management System. One component of this system is the Incident Command System.

All radio communication in the United Statesis under authorization from the Federal Communications Commission (FCC); as such, fire departments that operate radio equipment must hold radio licenses from the FCC. Ten codes were popular in the early days of radio equipment because of poor transmission and reception. Advances in modern radio technology have reduced the need for ten-codes and many departments have converted to simple English

(clear text). A New York Cityfireman calls for ten more rescue workers to make their way into the rubble of the World Trade Center.

16. Structure fires

16.1. A firefighter of the ACT Fire Brigade

Buildings that are made of flammable materials such as wood are different from so called "fire-resistant" buildings such as concrete high-rises. Generally, a "fire-resistant" building is designed to limit fire to a small area or floor. Other floors can be safe simply by preventing smoke inhalation and damage. All buildings suspected of being on fire must be evacuated, regardless of fire rating.

While sometimes fires can be limited to small areas of a structure, wider collateral damage due to smoke, water, and burning embers is common. Utility shutoff (such as gas and electricity) is typically an early priority of arriving fire crews. Furthermore, fire prevention can take on a special meaning for property where hazardous materials are being used or stored.

16.2. ACTFB fire trucks

Some fire fighting tactics may appear to be destructive, but often serve specific needs. For example, during "ventilation" firefighters are often forced to open holes in the roof or floors of a structure (called "vertical ventilation") or open windows or walls (called "horizontal ventilation") to remove smoke and heated gases from the interior of the structure. Such ventilation methods are also used to locate victims quicker as visibility increases and to help preserve the life of trapped or unconscious individuals due to the poisonous gases inside of the structure. Vertical Ventilation is absolutely vital to firefighter safety in the event of a Flashover or Backdraft scenario. Releasing the flammable gasses through the roof often eliminates the possibility of a backdraft and by the removal of heat the possibility of a flashover is reduced significantly. Flashovers, due to their intense heat (900 - 1200 degrees fahrenheit) and explosive temperaments are almost always fatal to firefighter personnel. Precautionary methods, such as busting a window out, often reveal backdraftsituations before the firefighter enters the structure and is met with the circumstance head-on. Firefighter safety is the number one priority.

Whenever possible, movable property is moved into the middle of a room and covered with a heavy cloth tarp (a "salvage cover"). Other steps may be taken to divert or remove fire flow runoff (thus salvaging property by avoiding unnecessary damage), retrieving/protecting valuables found during suppression or overhaul, and boarding windows, roofs and doors against the elements and looters.

16.3. Fire control

Fire control (or fire fighting) consists of depriving a fire of fuel (Reducing Agent), oxygen (Oxidizing Agent), heat and/or the chemical chain reaction that are necessary to sustain itself or re-kindle (also known as the four components of The Fire Tetrahedron). Firefighters are equipped with a wide variety of equipment to accomplish this task. Some of their tools include ladder trucks, pumper trucks, tanker trucks, fire hose, and fire extinguishers. Very frequent training and refresher training is required.

Structure fires may be attacked, generally, either by "interior" or "exterior" resources, or both. Interior crews, using the "two-in, two out" rule, may advance hose lines inside the building, find the fire and cool it with water. Exterior crews may direct water into windows or other openings, or against other nearby fuels exposed to the initial fire. A proper command structure will plan and coordinate the various teams and equipment to safely execute each tactic. Firefighters trying to save an abandoned

Topic Objective:

- Fire safety education
- Fire protection
- Fire protection Structure
- Fire safety education
- Target Audiences
- Fire protection Operations
- Fire safety
- Fire code
- Hazardous Materials Appliances

- Logistical Support Appliances
- Design and construction
- Visual warnings
- Passive visual warnings
- Active visual warnings
- Audible warnings

Definition/Overview:

Fire safety education All fire departments-- have a fire safety education program and one of the functions of Fire Prevention Officers is to visit schools to educate the children both in how to prevent fires and the actions they should take in the event of a fire occurring.

Fire protection: Fire protection is the safety and of the hazards associated with fires. It involves the study of the behaviour,compartmentalisation, suppression and investigation of fire and its related emergencies as well as the research and development, production, testing and application of mitigating systems.

Key Points:

1. Fire protection Structure

In structures, be they land-based, offshore or even ships, the owners and operators are responsible to maintain their facilities in accordance with a design-basis that is rooted in laws, including the local building code and fire code, which are enforced by the Authority Having Jurisdiction. Buildings must be constructed in accordance with the version of the building code that is in effect when an application for a building permit is made. Building inspectors check on compliance of a building under construction with the building code. Once construction is complete, a building must be maintained in accordance with the current fire code, which is enforced by the fire prevention officers of a local fire department. In the event of fire emergencies, Firefighters, fire investigators, and other fire prevention personnel called to mitigate, investigate and learn from the damage of a fire. Lessons learned from fires are applied to the authoring of both building codes and fire codes.

2. Fire safety education

Fire prevention programs may include distribution of smoke detectors, visiting schools to review key topics with the students and implementing nationally recognized programs such as NFPAs "Risk Watch" & "Learn not to burn." Other programs or props can be purchased readily by fire departments or community organizations. Notably, these are usually entertaining, capture children's attention and relay important messages. Such props include types that are mostly auditory, such as puppets & robots. The prop is visually stimulating but the safety message is only transmitted orally. Other props are more elaborate, access more senses and increase the learning factor. They mix audio messages and visual queues as well as hands-on interaction. Examples of these include mobile trailer safety houses and tabletop hazard house simulators.

All programs tend to mix messages of general injury prevention, safety, fire prevention and escape in case of fire. In most cases the fire department representative is regarded as the expert and is expected to present information in a manner that is appropriate for each age group. All fire authorities have a fire safety education program and one of the functions of Fire Prevention Officers is to visit schools to educate the children both in how to prevent fires and the actions they should take in the event of a fire occurring. Fire prevention programs may include distribution of smoke detectors, visiting schools to review key topics with the students and implementing nationally recognized programs such as NFPAs "Risk Watch" & "Learn not to burn."

Other programs or props can be purchased readily by fire departments or community organizations. Notably, these are usually entertaining, capture children's attention and relay important messages. Such props include types that are mostly auditory, such as puppets& robots. The prop is visually stimulating but the safety message is only transmitted orally. Other props are more elaborate, access more senses and increase the learning factor. They mix audio messages and visual queues as well as hands-on interaction. Examples of these include mobile trailer safety houses and tabletop hazard house simulators.

3. Target Audiences

In the United States, the very young and the elderly are considered to be "at risk" populations. These two groups represent approximately 33% of the population and are targeted to receive fire safety information

4. Fire protection Operations

Building a facility in accordance with the version of the local building code in effect at the time of building permit application Maintaining a facility and conducting oneself in accordance with the provisions of the fire code, from the moment that the building was occupied. This is based on thorough knowledge of the code by the owner and ensuring that the occupants and operators of the building are fully aware of the currently applicable regulations, including supplementary documents that may be applicable, which are referenced in the fire code, such as, as an example, NFPA-13 or NFPA-96.

5. Fire safety

Fire safety refers to precautions that are taken to prevent or reduce the likelihood of a fire that may result in death, injury, or property damage, alert those in a structure to the presence of a fire in the event one occurs, better enable those threatened by a fire to survive, or to reduce the damage caused by a fire. Fire safety measures include those that are planned during the construction of a building or implemented in structures that are already standing, and those that are taught to occupants of the building.

Threats to fire safety are referred to as fire hazards. A fire hazard may include a situation that increases the likelihood a fire may start or may impede escape in the event a fire occurs. Fire safety is often a component of building safety. Those who inspect buildings for violations of the Fire Code and go into schools to educate children on Fire Safety topics are fire department members known as fire prevention officers. The Chief Fire Prevention Officer or Chief of Fire Prevention will normally train newcomers to the Fire Prevention Division and may also conduct inspections or make presentations.

6. Fire code

The Fire code (also Fire prevention code or Fire safety code) is a model code adopted on a regional basis and enforced by fire prevention officers within municipal fire departments. It is a set of rules prescribing minimum requirements to prevent fire and explosion hazards arising from storage, handling, or use of dangerous materials, or from other specific hazardous conditions and complements the building code. The fire code is aimed primarily at preventing fires, ensuring that necessary training and equipment will be on hand, and the design basis of

the building, including a basic plan set out by the architect, is not compromised. The fire code also addresses inspection and maintenance requirements of various fire protection equipment in order to maintain optimal active fire protection and passive fire protection measures, with the products used in accordance with their certification listing.

A typical fire safety code includes administrative sections about the rule-making and enforcement process, and substantive sections dealing with fire suppression equipment, particular hazards such as containers and transportation for combustible materials, and specific rules for hazardous occupancies, industrial processes, and exhibitions.

Sections may lay out the requirements for obtaining permits and specific precautions required to remain in compliance with a permit. For example, a fireworks exhibition may require an application to be filed by a licensed pyrotechnician, providing the information necessary for the issuing authority to determine whether safety requirements can be met. Once a permit is issued, the same authority (or another delegated authority) may inspect the site and monitor safety during the exhibition, with the power to halt operations, when unapproved practices are seen or when unforeseen hazards arise.

7. Hazardous Materials Appliances

Some fire departments keep special appliances for dealing with hazardous materials, or "HazMat". These are of several types, from those used to clean spilled oil on streets and highways, to full decontamination units, designed to clean victims and rescuers of contaminants after an incident.

8. Logistical Support Appliances

Many fire departments operate a number of vehicles in specialised logistical functions. These can be stand alone vehicles, or may be modular, such as with the use of a 'hookloader' system

Sometimes hookloadersare used for seldom-used equipment. A hookloader can load a container very rapidly and act as a special unit with lower investment costs. For example, the Helsinki Rescue Department in Finland has several hookloader trucks and more than 40 containers including a water container, a hose container, an oil destruction container. Containers may also carry a command post, material for catastrophes, hoses and pumps for forest fires, even field hospitals, or for example, high-power pumps.

9. Design and construction

Many fire appliances around the world are based on standard truck or lorry models, which are upgraded to the specifications required by the purchasing department. In the United States, a majority of fire trucks are specially designed from the chassis to the cab and body. This has led to the use of the term custom fire truck, as opposed to a commercial chassis and cab.

Modifications a fire appliance might undergo include adjustments for higher durability, removal of any speed limiter, and adjustments for long periods of idling at a higher temperature. This may be accomplished by heavy duty suspensions, brakes, tires, alternator, transmission and cooling systems. It is also usual to upgrade the capacity of the electrics of the vehicle, in order to accommodate the use of additional electrical and electronic equipment. Fire appliances have audible and visual warnings, to protect themselves from traffic, and make themselves seen to other units at an incident. In many countries, use of the audible and visual warnings affords the driver a degree of exemption from road traffic laws (such as the right to exceed speed limits, treat red stop lights as give way etc.) and may also infer a duty on other motorists to move out of the direction of passage of the fire vehicle (or face possible prosecution).

10. Visual warnings

Visual warnings on a fire appliance can be of two types - either passive or active.

11. Passive visual warnings

The passive visual warnings involve the use of high contrast patterns. Older vehicles (and those in developing countries) are more likely to have their patterns painted on, whereas modern appliances often carry retro-reflective designs which reflect light from car headlights or torches. Patterns include 'checker board' (alternate coloured squares, sometimes called 'battenburgmarkings', named after a type of cake), chevrons (arrowheads - often pointed towards the front of the vehicle if on the side, or pointing vertically upwards if on the rear) or stripes (along the side - these were the first type or retro-reflective devices introduced, as the original retro-reflective material came only in tape form). In some countries, in addition to retro-reflective markings, vehicles are now painted a bright yellow or orange, although in many other countries, red remains the colour for fire engines.

Another passive marking is the word FIRE, RESCUE or local language variant spelled out in reverse on the front of the vehicle. This enables drivers of other vehicles to more easily identify an approaching fire service vehicle in their rear view mirrors. The appliance may also display a telephone number which may be used to summon assistance, along with the name of the operating department or station identifier.

12. Active visual warnings

The active visual warnings are usually in the form of flashing coloured lights (also known as 'beacons' or 'lightbars'). These flash in order to attract the attention of other road users as the fire appliance approaches, or to provide warning to motorists approaching a stopped appliance in a dangerous position on the road. Common coloursfor fire warning beacons are blue and red. The beacons can be made to flash, the original method was to place a spinning mirror which moves around a light bulb, called a 'rotating beacon'. More modern methods include the use of strobe lights, which are usually brighter, and can be programmed to produce specific patterns (such as a left -> right pattern when parked on the left hand side of the road, indicating to other road users that they should move out away from the vehicle). There is also the more widespread use of LED flashing lights as they are low profile and low energy.

13. Audible warnings

In addition to visual warnings, most appliances are also fitted with audible warnings, sometimes known as sirens, which can alert people and vehicles to the presence of an emergency vehicle before they can be seen. The first audible warnings were mechanical bells, mounted to either the front or roof of the truck. Most vehicles are now fitted with electronic sirens, which can produce a range of different noises. Fire service driving training often includes the use of different noises depending on traffic conditions and manoeuvre being performed. For instance, on a clear road, approaching a junction, the 'wail' setting may be used, which gives a long up and down variation, with an unbroken tone, whereas, in heavy slow traffic, a 'yelp' setting may be preferred, which is like a wail, but sped up. The speakers for modern sirens can be located in several places on the vehicle, including being integral to the lightbar, or hidden in the grille. Some vehicles may also be fitted with airhorn audible warnings. A number of North American fire departments have returned to the 'acoustic' or 'air' traditional siren as its overtones help the public 'locate' and avoid the firetruck--the newer

electronic signals disperse almost pure tones which are hard to locate, especially in city 'canyons' of buildings.

A development is the use of the RDS system of car radios, whereby the vehicle can be fitted with a short range FM transmitter, set to RDS code 31, which interrupts the radio of all cars within range, in the manner of a traffic broadcast, but in such a way that the user of the receiving radio is unable to opt out of the message (as with traffic broadcasts). This feature is built in to all RDS radios for use in national emergency broadcast systems, but short range units on emergency vehicles can prove an effective means of alerting traffic to their presence, although is not able to alert pedestrians and non-RDS radio users

In Section 2 of this course you will cover these topics:

- Enforcing Fire Safety Compliance
- Fire Safety Inspection Procedures
- Preparing Fire Service Personnel For Fire Prevention Duties

Topic Objective:

- Fire code
- Officer Commanding
- Applications
- Structure
- Work specialization
- Chain of command
- Authority, responsibility, and accountability
- Delegation
- Line and staff authority
- Span of management
- Tall versus flat structure
- Centralisation, decentralisation, and formalization
- Departmentalization
- Importance of organising

- Cooperation vs. competition
- The Prisoner's Dilemma
- Basis Incidents
- Events
- Clear Text (Common Terminology)
- Management by Objective

Definition/Overview:

Fire code: The Fire code (also Fire prevention code or Fire safety code) is a model code adopted by the state or local jurisdiction and enforced by fire prevention officers within municipal fire departments. It is a set of rules prescribing minimum requirements to prevent fire and explosion hazards arising from storage, handling, or use of dangerous materials, or from other specific hazardous conditions. It complements the building code. The fire code is aimed primarily at preventing fires, ensuring that necessary training and equipment will be on hand, and that the original design basis of the building, including the basic plan set out by the architect, is not compromised. The fire code also addresses inspection and maintenance requirements of various fire protection equipment in order to maintain optimal active fire protection and passive fire protection measures.

Key Points:

1. Fire code

A typical fire safety code includes administrative sections about the rule-making and enforcement process, and substantive sections dealing with fire suppression equipment, particular hazards such as containers and transportation for combustible materials, and specific rules for hazardous occupancies, industrial processes, and exhibitions.
Sections may establish the requirements for obtaining permits and specific precautions required to remain in compliance with a permit. For example, a fireworks exhibition may require an application to be filed by a licensed pyrotechnician, providing the information necessary for the issuing authority to determine whether safety requirements can be met. Once a permit is issued, the same authority (or another delegated authority) may inspect the site and monitor safety during the exhibition, with the power to halt operations, when unapproved practices are seen or when unforeseen hazards arise.

2. Officer Commanding

Normally an Officer Commanding is a company, squadron or battery commander (typically a Major). However, the commanders of independent units of smaller than company size, detachments and administrative organisations, such as schools or wings, may also be designated Officers Commanding.

The term Officer Commanding cannot be applied to any officer who is given command of a minor unit. For example, a platoon commander whose platoon is part of a company would not be an Officer Commanding. The Officer Commanding with power over that platoon would be the company OC. Officer Commanding is an appointment that confers a level of additional powers and responsibilities on the appointee.

Officers Commanding are generally given the same power and responsibilities as Commanding Officers of battalions and regiments. They are held responsible for the unit's properties and monies, can hear disciplinary charges against soldiers, sailors, or airmen under their command, and can delegate these powers.

3. Applications

Organizing, in companies point of view, is the management function that usually follows after planning. And it involves the assignment of tasks, the grouping of tasks into departments and the assignment of authority and allocation of resources across the organization.

4. Structure

The framework in which the organization defines how tasks are divided, resources are deployed, and departments are coordinated.

- A set of formal tasks assigned to individuals and departments.
- Formal reporting relationships, including lines of authority, decision responsibility, number of hierarchical levels and span of managers control.
- The design of systems to ensure effective coordination of employees across departments.
-

5. Work specialization

The degree to which organizational tasks are sub divided into individual jobs; also called division of labour. With too much specialization, employees are isolated and do only a single, tiny, boring job. Many organizations enlarge jobs to provide greater challenges or assigning to tasks that are rotated.

6. Chain of command

An unbroken line of authority that links all individuals in the organization and specifies who reports to whom.

- Unity of Command - one employee is held accountable to only one supervisor
- Scalar principle - clearly defined line of authority in the organization that includes all employees.

7. Authority, responsibility, and accountability

7.1.Authority

Formal and legitimate right of a manager to make decisions, issue orders, and allocate resources to achieve organizationally desired outcomes.

7.2.Responsibility

Responsibility is define as the duty to perform the task or activity an employee has been assigned

7.3.Accountability

Accountability is the fact that the people with authority and responsibility are subject to reporting and justifying task outcomes to those above them in the chain of command

8. Delegation

The process managers use to transfer authority and responsibility to positions below them in the hierarchy.Organisations today tend to encourage delegation from highest to lowest

possible levels. Can improve flexibility to meet customers needs and adaptation to competitive environments. Managers often find delegation difficult.

9. Line and staff authority

9.1.Line authority

It is the authority in which individuals in management positions have the formal power to direct and control immediate subordinates.

9.2.Staff authority

This authority granted to staff specialists in their areas of expertise. Narrower than line authority and includes the right to advise, recommend, and counsel in the staff specialists' area of expertise. It is a communication relationship with management.

10. Span of management

Factors influencing larger span of management

- Work performed by subordinates is stable and routine.
- Subordinates perform similar work tasks.
- Subordinates are concentrated in a single location.
- Subordinates are highly trained and need little direction in performing tasks.
- Rules and procedures defining task activities are available.
- Support systems and personnel are available for the managers.
- Little time is required in nonsupervisory activities such as coordination with other departments or planning.
- Managers' personal preferences and styles favour a large span.

11. Tall versus flat structure

11.1. Tall

A management structure characterised by an overall narrow span of management and a relatively large number of hirarchicallevels. Tight control.

11.2. Flat

A management structure characterised by a wide span of control and relatively few hirarchical levels. Loose control. Facilitates delegation.

12. Centralisation, decentralisation, and formalization

12.1. Centralisation

The location of decision making authority near top organisationallevels.

12.2. Decentralisation

The location of decision making authority near lower organisationallevels.

12.3. Formalisation

The written documentation used to direct and control employees.

13. Departmentalization

The basis on which individuals are grouped into departments and departments into total organisations. Approach options include;

- Functional - by common skills and work tasks
- Divisional - common product, programme or geographical location
- Matrix - combination of Functional and Divisional
- Team - to accomplish specific tasks
- Network - departments are independent providing functions for a central core breaker

14. Importance of organising

Organisationsare often troubled by how to organise, particularly when a new strategy is developed. Changing market conditions or new technology requires change. Organisations seek efficiencies through improvements in organizing

15. Cooperation vs. competition

While cooperation is the antithesis of competition, the need or desire to compete with others is a common impetus that motivates individuals to organize into a group and cooperate with each other in order to form a stronger competitive force.

Cooperation in many areas, such as farming and housing, may be in the form of a cooperative or, alternately, in the form of a conventional business. Many people resort to this because, they may cooperate by trading with each other or by altruistic sharing.

Certain forms of cooperation are illegal in some jurisdictions because they alter the nature of access by others to economic or other resources. Thus, cooperation in the form of cartels or price-fixing may be illegal. A few mechanisms have been suggested for the appearance of cooperation between humans or in natural system

16. The Prisoner's Dilemma

Even if all members of a group would benefit if all cooperate, individual self-interest may not favor cooperation. The prisoner's dilemma codifies this problem and has been the subject of much research, both theoretical and experimental. Results from experimental economics show that humans often act more cooperatively than strict self-interest would seem to dictate.

One reason for this may be that if the prisoner's dilemma situation is repeated (the iterated prisoner's dilemma), it allows non-cooperation to be punished more, and cooperation to be rewarded more, than the single-shot version of the problem would suggest. It has been suggested that this is one reason for the evolution of complex emotions in higher life forms, who, at least as infants, and usually thereafter, cannot survive without cooperating - although with maturation they gain much more choice about the kinds of cooperation they wish to have. There are four main conditions that tend to be necessary for cooperative behaviourto develop between two individuals:

- An overlap in desires
- A chance of future encounters with the same individual
- Memory of past encounters with that individual
- A value associated with future outcomes

17. Basis Incidents

Incidents are defined within ICS as unplanned situations necessitating a response. Examples of incidents may include:

- Any emergency medical situation (ambulance service)
- A Hazardous Materials spill
- Terrorist attacks
- Natural disasters such as wildfires, flooding, earthquake or tornado
- Man-made disasters such as vehicle crashes, industrial accidents, train derailments, or structural fires
- Search and Rescue operations

18. Events

Events are defined within ICS as planned situations. Incident command is increasingly applied to events both in emergency management and non-emergency management settings. Examples of events may include:

- Concerts
- Parades and other ceremonies
- Fairs and other gatherings
- Training exercises
- Foundations

Unity of Command means that each individual participating in the operation reports to only one supervisor. This eliminates the potential for individuals to receive conflicting orders from a variety of supervisors, thus increasing accountability, preventing freelancing, improving the flow of information, helping with the coordination of operational efforts, and enhancing operational safety.

19. Clear Text (Common Terminology)

Clear Text (Common terminology) describes the format and phrasing of all incident communications. As an emergency response organization is often made of individuals who normally do not work together as a team, when they come together the use of common

terminology is viewed as an essential element in team building and communications, both internally and with other organizations responding to the incident. The Incident Command System promotes the use of common terminology, and has an associated glossary of terms that help bring consistency to position titles, the description of resources and how they can be organized, the type and names of incident facilities, and a host of other subjects. The most apparent implementation of this concept is in radio communication; 10-codes (e.g. "10-4" to mean "I understand"), acronyms, and potentially arcane abbreviations are not to be used on the radio. Radio prowords (e.g. "Wilco" to mean "I understand and will comply") are generally accepted due to their universality.

20. Management by Objective

Management by Objective is the heart of management planning. In principle, all actions at an incident should be directed toward satisfying a major goal of the incident. The Incident Commander and Planning Section are responsible for the development of strategic objectives that clearly define what the incident team is working to achieve during operations. Based upon the information presented at the initial incident planning meeting and the analysis of incident potential and impacts, the Incident Commander and Section Chiefs should have a clear understanding of the major goals that need to be completed. Objectives are usually written, and any event with a written Incident Action Plan must have the objectives included in that written plan.

21. Flexible/Modular Organization

Flexible/Modular Organization describes the ability of an Incident Command structure to expand and contract efficiently as needed by the incident scope or available personnel. Only positions that are required for an adequate response should be filled, and ICS sections are kept as small as possible to accomplish incident objectives and monitor progress, within effective span-of-control. The level of response necessary for a specific incident dictates how and when the organization develops, and in many instances not all sections need to be activated. Only in the largest and most complex operations would the full ICS organization be staffed.

22. Span-of-control

Span-of-control is the most fundamentally important management principle of ICS. It applies to the management of individual responsibilities and response resources. The objective is to limit the number of responsibilities being handled by, and the number of resources reporting directly to, an individual. ICS considers that any single person's span of control should be between three and seven, with five being ideal. In other words, one manager should have no more than seven people working under them at any given time.

When span-of-control problems arise around an individual's ability to address responsibilities, they can be addressed by expanding the organization in a modular fashion. This can be accomplished in a variety of ways. An Incident Commander can delegate responsibilities to a deputy and/or activate members of the Command Staff. Members of the Command Staff can delegate responsibilities to Assistants, etc. There may be exceptions, usually in lower-risk assignments or where resources work in close proximity to each other.

23. Coordination

Coordination on any incident or event is possible and effective due to the implementation of the following concepts:

24. Incident Action Plan

Incident Action Plans include the measurable strategic operations to be achieved and are prepared around a time frame called an Operational Period. Incident Action Plans may be verbal or written (except for hazardous material incidents where it has to be written), and are prepared by the Planning Section. The IAP insures that everyone is working in concert toward the same goals set for that operational period. The purpose of this plan is to provide all incident supervisory personnel with direction for actions to be implemented during the operational period identified in the plan. Incident Action Plans provide a coherent means of communicating the overall incident objectives in the context of both operational and support activities. The consolidated IAP is a very important component of the ICS that reduces freelancing and ensures a coordinated response. At the simplest level, all Incident Action Plans must have four elements:

- What do we want to do?
- Who is responsible for doing it?
- How do we communicate with each other?
- What is the procedure if someone is injured?

25. Comprehensive Resource Management

Comprehensive Resource Management is a key management principle that implies that all assets and personnel during an event need to be tracked and accounted for. It can also include processes for reimbursement for resources, as appropriate. Resource management includes processes for:

- Categorizing resources.
- Ordering resources.
- Dispatching resources.
- Tracking resources.
- Recovering resources.

Comprehensive Resource Management ensures that visibility is maintained over all resources so they can be moved quickly to support the preparation and response to an incident, and ensuring a graceful demobilization. It also applies to the classification of resources by type and kind, and the categorization of resources by their status. Assigned resources are those that are working on a field assignment under the direction of a supervisor. Available resources are those that are ready for deployment, but have not been assigned to a field assignment.

Out-of-service resources are those that are not in either the " available" or "assigned" categories. Resources can be "out-of-service" for a variety of reasons including: resupplying after a sortie (most common), shortfall in staffing, personnel taking a rest, damaged/inoperable.

26. Integrated Communications

The use of a common communications plan is essential for ensuring that responders can communicate with one another during an incident. Communication equipment, procedures, and systems must operate across jurisdictions (interoperably). Developing an integrated voice

and data communications system, including equipment, systems, and protocols, must occur prior to an incident.

27. Incident Commander

27.1. Single Incident Commander

Most incidents involve a single Incident Commander. In these incidents a single person commands the incident response and is the decision-making final authority.

27.2. Unified Command

A Unified Command is used on larger incidents usually when multiple agencies are involved. A Unified Command typically includes a command representative from major involved agencies and one from that group to act as the spokesman, though not designated as an Incident Commander. A Unified Command acts as a single entity.

27.3. Area Command

During multiple-incident situations, an Area Command may be established to provide for Incident Commanders at separate locations. Generally, an Area Commander will be assigned - a single person - and the Area Command will operate as a logistical and administrative support. Area Commands usually do not include an Operations function.

28. Command Staff

28.1. Safety Officer

The Safety Officer monitors safety conditions and develops measures for assuring the safety of all assigned personnel.

28.2. Public Information Officer

The Public Information Officer serves as the conduit for information to internal and external stakeholders, including the media or other organizations seeking information directly from the incident or event.

28.3. Liaison

A Liaison serves as the primary contact for supporting agencies assisting at an incident.

29. General Staff

29.1. Operations Section Chief

The Operations Section Chief is tasked with directing all actions to meet the incident objectives.

29.2. Planning Section Chief

The Planning Section Chief is tasked with the collection and display of incident information, primarily consisting of the status of all resources and overall status of the incident.

29.3. Finance/Administration Section Chief

The Finance/Admin. Section Chief is tasked with tracking incident related costs, personnel records, requisitions, and administrating procurement contracts required by Logistics.

29.4. Logistics Section Chief

The Logistics Section Chief is tasked with providing all resources, services, and support required by the incident.

30. Facilities

ICS uses a standard set of facility nomenclature. ICS facilities include: Pre-Designated Incident Facilities: Response operations can form a complex structure that must be held together by response personnel working at different and often widely separate incident facilities. These facilities can include:

31. Incident Command Post (ICP)

The ICP is the location where the Incident Commander operates during response operations. There is only one ICP for each incident or event, but it may change locations during the event. Every incident or event must have some form of an Incident Command Post. The ICP may be located in a vehicle, trailer, tent, or within a building. The ICP will be positioned outside of the present and potential hazard zone but close enough to the incident to maintain command. The ICP will be designated by the name of the incident, e.g., Trail Creek ICP.

31.1. Staging Area

Can be a location at or near an incident scene where tactical response resources are stored while they await assignment. Resources in staging area are under the control of the Logistics Section and are always in available status. Staging Areas should be located close enough to the incident for a timely response, but far enough away to be out of the immediate impact zone. There may be more than one Staging Area at an incident. Staging Areas can be collocated with the ICP, Bases, Camps, Helibases, or Helispots.

31.2. Base

A Base is the location from which primary logistics and administrative functions are coordinated and administered. The Base may be collocated with the Incident Command Post. There is only one Base per incident, and it is designated by the incident name. The Base is established and managed by the Logistics Section. The resources in the Base are always out-of-service.

31.3. Camps

Locations, often temporary, within the general incident area that are equipped and staffed to provide sleeping, food, water, sanitation, and other services to response personnel that are too far away to use base facilities. Other resources may also be kept at a camp to support incident operations if a Base is not accessible to all resources. Camps are designated by geographic location or number. Multiple Camps may be used, but not all incidents will have Camps.

31.4. Helibase

A Helibase is the location from which helicopter-centered air operations are conducted. Helibases are generally used on a more long-term basis and include such services as fueling and maintenance. The Helibase is usually designated by the name of the incident, e.g. Trail Creek Helibase.

31.5. Helispots

Helispots are more temporary locations at the incident, where helicopters can safely land and take off. Multiple Helispotsmay be used.

Each facility has unique location, space, equipment, materials, and supplies requirements that are often difficult to address, particularly at the outset of response operations. For this reason, responders should identify, pre-designate and pre-plan the layout of these facilities, whenever possible. On large or multi-level incidents, higher-level support facilities may be activated.

32. Multiple Agency CoordinationCenter (MACC)

Also known as an Emergency OperationsCenter, the MACC is a central command and control facility responsible for the strategic, or "big picture" of the disaster. Personnel within the MACC use Multi-agency Coordination to guide their operations. The MACC coordinates activities between multiple agencies and does not normally directly control field assets, but makes strategic decisions and leaves tactical decisions to individual agencies. The common functions of all EOC'sis to collect, gather and analyze data; make decisions that protect life and property, maintain continuity of the government or corporation, within the scope of applicable laws; and disseminate those decisions to all concerned agencies and individuals.

33. Equipment

ICS uses a standard set of equipment nomenclature. ICS equipment include:

Tanker - This is an aircraft that carries fuel (Fuel Tanker) or water (Water Tanker).

Tender - Like a tanker, but a ground vehicle, also carrying fuel (Fuel Tender) or water (Water Tender).

34. Type and kind

The "type" of resource describes the size or capability of a resource. For instance, a 50 kW (for a generator) or a 3-ton (for a truck). Types are designed to be categorized as "Type 1" through "Type 5" formally, but in live incidents more specific information may be used. The "kind" of resource describes what the resource is. For instance, generator or a truck. The "type" of resource describes a performance capability for a kind of resource for instance,

In both type and kind, the objective must be included in the resource request. This is done to widen the potential resourse response. As an example, a resource request for a small aircraft for arial reconnaissance of a search and rescue scene may be satisfied by a National Guard OH-58 Kiowa helicopter (Type & Kind: Rotary-wing aircraft, Type II/III) or by a Civil Air Patrol Cessna 182 (Type & Kind: Fixed-wing aircraft, Type I). In this example, requesting only a fixed-wing or a rotary-wing, or requesting by type may prevent the other resource's availability from being known.

35. Command transfer

A role of responsibility can be transferred during an incident for several reasons: As the incident grows a more qualified person is required to take over as Incident Commander to handle the ever-growing needs of the incident, or in reverse where as an incident reduces in size command can be passed down to a less qualified person (but still qualified to run the now-smaller incident) to free up highly-qualified resources for other tasks or incidents. Other reasons to transfer command include jurisdictional change if the incident moves locations or area of responsibility, or normal turnover of personnel due to extended incidents. The transfer of command process always includes a transfer of command briefing, which may be oral, written, or a combination of both

Topic Objective:

- Investigating fires
- Recommended practices
- Conducting investigations
- Licensure
- National Association of Fire Investigators

- Forensic electrical engineering
- Goals
- Applications
- Liability

Definition/Overview:

Fire investigation: sometimes referred to as origin and cause investigation, is the analysis of fire-related incidents. After firefighters extinguish a fire, an investigation is launched to determine the origin and cause of the fire or explosion. Investigations of such incidents are done using a systematic approach and knowledge of basic fire science.

Key Points:

1. Investigating fires

Fire investigation is one of the most difficult of the forensic sciences to practice. In most forensic disciplines, even the basic question of whether a crime has been committed is normally obvious. During a fire investigation, an entire process must be undertaken just to determine if the case involves arson or not. The difficulty of determining whether an arson fire has occurred or not arises because fires destroy evidence. A fire investigator looks at what is left behind after a fire and obtains information to piece together the events that occurred in the moments leading up to the fire.

One of the challenging aspects of fire investigation is the multi-disciplinary base of the investigator's job. Fires can be caused by or involve most things people see or use. For this reason, fire investigators need to know not only basic science of fire behavior, but knowledge of many different areas of study (including construction, electricity, human behaviour, vehicles etc) is helpful. If the fire origin has, for example, a gas appliance, an investigator should know enough about appliances to either include or exclude it as a possible cause of the fire. Fire investigators must also know their own limitations and call upon experts to assist when needed. Accordingly, fire investigators sometimes work with forensic electrical engineers (when examining electrical appliances, household wiring, etc.) or others skilled in forensic engineering (gas-powered appliances, air handling equipment, gas delivery systems, etc.).

2. Recommended practices

In the United States, one of the guides fire investigators may refer to is published by the National Fire Protection Association (NFPA) for codes, standards, and suggested practices about conducting fire investigations. The most recent edition of this guide, titled NFPA 921: Guide for Fire and Explosion Investigations, was published in 2008. The information, standards, and practices discussed below are those which appear in NFPA 921.

3. Conducting investigations

Fire investigators conduct their investigations using a systematic approach. The approach endorsed by the NFPA is that of the scientific method (for a more detailed discussion, see the article on NFPA 921). There are five components that create a methodology with which fires are investigated using a systematic approach:

- The assignment is received and the investigator is notified of his/her responsibilities
- The investigator plans the investigation and assembles tools, equipment, and personnel
- The scene is examined and data is collected
- Physical evidence is collected, documented, tested, and evaluated
- The scientific method is used to analyze the information obtained

4. Licensure

- The International Association of Arson Investigators (IAAI), a professional group of fire investigators, grants a National Board Certified fire investigation certification called the "Certified Fire Investigator" (IAAI-CFI).
- For more information, please visit their website at http://www.firearson.com

5. National Association of Fire Investigators

The National Association of Fire Investigators (NAFI), a professional association of fire and explosion investigators, offer several National Board Certified fire investigation certifications, including:

- Certified Fire and Explosion Investigatior (CFEI),
- Certified Vehicle Fire Investigator (CVFI), and
- Certified Fire Investigation Instructor (CFII).
-

6. Forensic electrical engineering

Forensic electrical engineering is a branch of forensic engineering, and is concerned with investigating electrical failures and accidents in a legal context. Many forensic electrical engineering investigations apply to fires suspected to be caused by electrical failures. Forensic electrical engineers are most commonly retained by insurance companies or attorneys representing insurance companies, or by manufacturers or contractors defending themselves against subrogation by insurance companies. Other areas of investigation include accident investigation involving electrocution, and intellectual property disputes such as patent actions. Additionally, since electrical fires are most often cited as the cause for "suspect" fires an electrical engineer is often employed to evaluate the electrical equipment and systems to determine whether the cause of the fire was electrical in nature.

7. Goals

The ultimate goal of these investigations is often to determine the legal liability for a fire or other accident for purposes of insurance subrogation or an injury lawsuit. Some examples include:

7.1.Defective appliances

If a property fire was caused by an appliance which had a manufacturing or design defect (for example, a coffee maker overheating and igniting), making it unreasonably hazardous, the insurance company might attempt to collect the cost of the fire damage ("subrogate") from the manufacturer; if the fire caused personal injury or death, the injured party might also attempt an injury lawsuit against the manufacturer, in addition to the carrier of health or life insurance attempting subrogation.

7.2.Improper workmanship

If, for example, an electrician made an improper installation in a house, leading to an electrical fault and fire, he or she could likewise be the target of subrogation or an injury lawsuit (for this reason, electricians are required to carry liability insurance).

7.3.Electrical injury

If an electrical fault or unreasonably hazardous electrical system causes an electrical injury ("electrocution" if the injury is fatal), the party responsible for the electrical accident can be the target of insurance subrogation or an injury lawsuit.

7.4.Equipment failure

If electrical equipment stops functioning, it can cause a loss of income (such as a factory losing productivity due to inoperative equipment) or additional damage (such as food products spoiling due to loss of refrigeration), and again be the subject of a subrogation or liability case. Liability in such a case can also include the cost of repairing or replacing the equipment, which can be substantial.

8. Applications

Forensic electrical engineers are also involved in some arson and set-fire investigations; while it is not common for arsonists to cause electrical failures to ignite fires, the presence of electrical appliances and systems in many fires scenes often requires them to be evaluated as possible accidental causes of the fire. Some electrical means of ignition, when discovered, are fairly obvious to an origin and cause investigator and most likely do not require consulting with a forensic electrical engineer. (Note that "arson" refers specifically to a criminal act, subject to criminal prosecution; a more general term is a "set fire". A homeowner setting a fire deliberately in order to defraud an insurance company might be prosecuted for arson by a government body; however, the insurance company would concern itself only with denying the insurance claim, possibly leading to a civil lawsuit.) Patent disputes may also require the expert opinion of an electrical engineer to advise a court. Issues in conflict may include the precise meaning of technical terms (especially in the patent claims, the prior art in a particular product field and the obviousness of various patents.

9. Liability

Most states have a statute of ultimate repose (similar to, but not to be confused with, a statute of limitations) that limits the length of time after which a party can legally be held liable for their negligent act or defective product. Many states have a "useful life" statute of ultimate repose. Therefore, a determination of the length of time the product would normally be

expected to be used before wearing out needs to made. For example, a refrigerator might have a longer "useful life" than an eletric fan; an airplane might have a longer useful life than a car. Some states pick an arbitrary number of years for the statute of ulitimaterepose. It may be short (six or seven years) or longer 15 or 25 years. If a coffee maker starts on fire after the statute of ultimate repose has expired, the manufacturer can no longer be held liable for manufacturing or design defects. The statute of ultimate repose is different from the statute of limitations. In a state with a short statute of ultimate repose, it is common that a person's right to bring a claim in court expires before their injury ever occurs. Thus, if a defective product (for example a car) caused a collision when the steering failed, but the collision occurred after the expiration of a staute of ultimate repose, no claim could be brought against the manufacturer for selling a defective product. The right to bring the claim expired before the claim even occurred

Topic Objective:

- Types
- Fire Engine
- Rescue Engine
- Turntable Ladder
- Quint and Quad
- Hydraulic Platform
- Water Tenders
- Wildland fire appliances (apparatus)
- Airport Crash Tender
- Rescue Unit
- Hazardous Materials Appliances
- Logistical Support appliances
- Fireboat
- Command & Control
- Aircraft
- Design and construction
- Visual warnings

- Passive visual warnings
- Active visual warnings
- Audible warnings
- Additional equipment
- Crew assignment

Definition/Overview:

Fire apparatus: A fire apparatus, fire engine, fire truck, or fire appliance is a vehicle designed to assist in fighting fires, by transporting firefighters to the scene, and providing them with access, water or other equipment. In some areas, the terms fire engine and fire truck represent different types of fire fighting apparatus.

Key Points:

1.Fire apparatus Types

A fire apparatus, fire engine, fire truck, or fire appliance is a vehicle designed to assist in fighting fires, by transporting firefighters to the scene, and providing them with access, water or other equipment. In some areas, the terms fire engine and fire truck represent different types of fire fighting apparatus.

2.Fire Engine

The fire engine may have several methods of pumping the water to the fire. The most common method is to pass water through hoses to the fire, from an array of valves. The vehicle may also have a fixed pumping "cannon" (called a fire monitor or deluge), which can direct the water as pointed by the operator. The horizontal and vertical range of the monitor arrangement usually is limited and appropriate only for specific tasks, such as airport fires. Monitors have been used as water cannons for crowd control.

A fire engine may have an on-board water reservoir, allowing it to fight a fire immediately upon arrival, or may be completely reliant on external sources, such as fire hydrants, water tender, river or reservoir, by using draft water suction.

A development is the use of an impulse fire-extinguishing system (IFEX), in which the water is highly pressurised into a vaporous mist, creating a cooling effect that is more efficient than that of water alone. A modern fire engine is usually a multi-purpose vehicle carrying professionals and equipment for a wide range of fire-fighting and rescue tasks. Therefore, most fire engines carry equipment such as ladders, pike poles, axes, Halligans, fire extinguishers, and ventilating equipment. In some areas, a ladder truck may carry these tools as well. Such a vehicle would in that case be known as a "Hook and Ladder" truck.

The New York City Fire Department (FDNY) was the first to introduce the "squad" concept for an engine and developed the "rescue pumper. A typical FDNY squad has a 500 U.S.gallon (1900-L) water tank and specialized rescue equipment, but carries less hose than a standard engine. Since its introduction in New York, several other American cities have adopted the vehicles, sometimes calling them rescue engines.

3. Turntable ladder

The turntable ladder, also known as an aerial ladder, or sometimes abbreviated to simply TL is the best-known form of specialized fire apparatus (sometimes known as a fire truck), and is used to gain access to fires occurring at height, where conventional ladders carried on other appliances might not reach.

The name is derived from the fact that the large ladder is mounted on a turntable on the back of a truck or lorry, allowing it to pivot around a stable base, which in turn allows a much greater ladder length to be achieved). In order to increase its length, the ladder is telescopic. Modern turntable ladders are hydraulic or pneumatic in operation. A ladder also can be mounted behind the cab. This is called "mid ship". This arrangement allows a shorter wheel base for truck, and also can be more stable in some conditions. The turntable ladder units replaced the stand alone wheel mounted long ladders which were seen on fire engines before the widespread use of hydraulics.

While the traditional characteristic of a 'fire truck' was a lack of water pumping or storage, many modern turntable ladders have a water pumping function to them (and some have their own on board supply reservoir), and may have a pre-piped waterway running the length of the ladder, to allow the firefighters at the top a stream of water. In some cases, there may also be a monitor at the top of the ladder for ease of use. Other appliances may simply have a trackwaywhich will hold a manually run hose reel securely, and prevent it from falling to the ground.

Some turntable ladders may have a basket or platform (sometimes known as a bucket) mounted at the top of the ladder, as on a hydraulic platform, and these are called tower ladders. These can provide a secure place for a firefighter to operate equipment from, and allow multiple people to be carried (including rescued persons).

A tiller truck, also known as a tractor drawn aerial, is a specialised turntable ladder appliance mounted on a semi-trailer truck. It has separate steering wheels for front and rear wheels (the steering device for the rear is sometimes a tiller rather than a true steering wheel). This truck is often used in areas with narrow streets that prevent longer single-vehicle trucks from entering. Some cities, including Los Angeles, California,San Francisco, California,Baltimore, Maryland,Seattle, Washingtonand New York City, New York rely heavily on them.

In some areas, the turntable ladder appliance may be termed a 'hook and ladder' vehicle, as it will carry an array of ladders and hooks. Hooks are used most commonly for pulling drywall or plaster walls away from framing members to expose hidden fire, and to allow access for extinguishing the fire. Hooks can also be used for pulling siding, breaking windows, etc. Technically, any vehicle carrying hooks and ladders could be considered a hook and ladder vehicle.

4. Quint and Quad

In some areas, the turntable ladder may be known as a quad or quint, as it is capable of performing multiple tasks (pump, water tank, fire hose, aerial device, and ground ladders) with each of these functions making up one of its five (quint) or four (quad) cabilities.

5. Hydraulic platforms

A hydraulic platform, also known as articulating booms, snorkels, platform trucks or sometimes shortened to just HP, is a specialized aerial work platform designed for firefighting use. They have a number of functions, which follow the same principles as the turntable ladder, providing high level access and elevated water pump positions.

Some hydraulic platforms are articulated, which allows the arm to bend in one or more places, giving it the ability to go 'up and over' an obstacle (such as a building roof). There are non-articulated platforms, based on standard aerial work platforms, although the most common type is the tower ladder (mentioned above in the Turntable ladder section). Hydraulic platforms (articulated or not) may still have a ladder arrangement fitted to the arm, primarily as an emergency measure. In some jurisdictions these can be denoted ladder platforms. Most hydraulic platforms are designed to reach a height of around 33 metres(100 feet), although larger models are capable of reaching heights of over 100 metres (328 feet). Many hydraulic platforms are fitted with additional equipment in the platform itself, which can include a control panel, lighting equipment, a fixed water outlet or monitor, power outlets or compressed air outlets (allowing the fixing of rescue equipment, such as the jaws of life). Many platforms are also adapted or capable of carrying a stretcher. Some units have video systems and remote control in case of dangerous chemical fires.

Some hydraulic platforms might also be designated as a quad or quint engine, as it is capable of performing multiple tasks (pump, water tank, fire hose, aerial device, and ground ladders)

6.Aerial water towers

In some instances, fire departments may have a specialised aerial water tower, the purpose of which is to deploy an elevated master stream of water, although it does not provide any access for firefighters. In most departments, this function is now performed by a hydraulic platform or turntable ladder, so this type of appliance is quite rare, and most examples of this type of unit are historical. The historical units of this type were usually manually or mechanically raised and lowered using friction drums or ratchet mechanisms.

7. Water tenders

A water tender, which can also be known as a tanker truck or water bowser is a specialist fire appliance with the primary purpose of transporting large amounts of water to a scene. These are especially useful in rural areas where fire hydrants are not readily available.

Most tenders have an on-board pumping system. This pump is often not of sufficient power to fight fires (as it is designed to be attached to a fire engine), but is more often used to draw water in to the tender from hydrants or other water sources. In some areas, the tenders are used to pump water during floods, and may be fitted with a heavier duty pump for this purpose.

Most water tenders are designed to carry loads of 1000 gallons (approx. 3800 litres) or more. In the US, 1000 gallons is the requirement in the NFPA standards. Some may carry up to or even upwards of 5000 gallons (more than 20 000 litres) of water - with a trailer even more .

8. Wildlandfire appliances

In heavily forested areas, a special kind of fire truck known as a brush truck is used. They are usually trucks with off-road capabilities for traversing rough terrain in order to reach the fire.

9. Airport crash tender

An airport crash tender is a fire engine designed for use at aerodromes and airports in aircraft accidents. The features include a good acceleration, ability to move on rough terrains outside the runway and airport area, large water capacity, foam tank, a high-capacity pump, and water/foam monitors with a good throw distance. Newer AR-FF vehicles also incorporate Twin Agent nozzles/injection systems to inject a stream of Purple-K dry chemical into the AFFF foam stream "knocking-down" the fire faster. Some also have Halotrontanks with handlines for situations that require a clean agent to be utilized. These features give the airport crash tenders a capability to reach an airplane rapidly, and rapidly put out large fires with jet fuel involved.

Some tenders have an elevated extended extinguishing arm called a Snozzle, giving a possibility to raise a water/foam cannon into the height of approx. 10 - 20 meters. Some arms have reinforced nozzles that can puncture through superficial structures of an aeroplane to fight a fire inside the fuselage. Airport crash tender using a puncture nozzle to spray inside of an airframe. At bottom left is a closeup of the head of the nozzle showing the puncture nozzle (top), a standard nozzle (bottom), a light and a thermal imager (left and right). Airport crash tender using a puncture nozzle to spray inside of an airframe. At bottom left is a closeup of the head of the nozzle showing the puncture nozzle (top), a standard nozzle (bottom), a light and a thermal imager (left and right).

ICAO (International Civil Aviation Organization) has given standards and recommended practices on rescue fire fighting categories of civil aerodromes . National aviation authorities may have given even further requirements on aerodrome rescue and fire services.

The rescue fire services are based on a critical aircraft based on a statistical analysis of movements (take-offs and landings) on the airport. The aerodrome category is based on the size of the biggest aircraft taking a movement on the aerodrome. In addition, the number of movements of the critical aircraft is calculated, and the category can be decreased by one if the number of movements is lower than the standard describes. There are also minimum category levels based on e.g. the number of seats in the critical aircraft.

Depending on the airport category, the standards determine the minimum number of rescue fire-fighting vehicles. In addition, requirements are given on the water and foam capacities, discharge rates for foam solutions, and minimum dry chemical powder (complementary agent) amounts, reserve stocks of fire fighting agents, ability to operate on rough terrain, and acceleration of the air crash tenders. The end of each runway has to be achieved in a response time of two minutes, and any part of the movement area has to be achieved in a response time not exceeding three minutes.

10. Rescue Unit

A heavy rescue vehicle, often referred to as a rescue company, rescue squad, technical rescue, heavy rescue, or simply, fire engine is a type of specialty firefighting or EMS(Emergency

Medical Services) apparatus. Essentially giant toolboxes on wheels, they are primarily designed for technical rescue situations such as auto accidents, rope rescues, swiftwater rescues, or collapses.

NFPA (National Fire Protection Association in the U.S.) regulation 1006 and 1670 give guidelines and regulations for the operation of heavy rescue vehicles and also state that all "rescuers" must have medical training to perform any technical rescue operation, including cutting the vehicle itself. In most rescue environments, fire department personnel conduct rescue operations working hand-in-hand with medical personnel such as EMT or paramedics.

In addition to fire brigades and rescue departments, e.g. tram or railway companies may have their own heavy rescue squads specialized to tram or train accidents. For example, railway rescue squads may carry very specialized equipment for railway accidents like hydraulic jacks with capacity for lifting locomotives or even move them horizontally, and equipment for tank car accidents.

11. Hazardous Materials Appliances

Some fire departments keep special appliances for dealing with hazardous materials, or "HazMat". These are of several types, from those used to clean spilled oil on streets and highways, to full decontamination units, designed to clean victims and rescuers of contaminants after an incident.

12. Logistical Support Appliances

Many fire departments operate a number of vehicles in specialised logistical functions. These can be stand alone vehicles, or may be modular, such as with the use of a 'hookloader' system

Sometimes hookloadersare used for seldom-used equipment. A hookloader can load a container very rapidly and act as a special unit with lower investment costs. For example, the Helsinki Rescue Department in Finland has several hookloader trucks and more than 40 containers including a water container, a hose container, an oil destruction container. Containers may also carry a command post, material for catastrophes, hoses and pumps for forest fires, even field hospitals, or for example, high-power pumps.

12.1. Fireboat

Some fire companies that protect a body of water, such as a major city harbor, may utilize fireboats to combat fires on watercraft and waterfront areas.

12.2. Aircraft

Fire companies may also employ airplanes and helicopters to attack fire from the air. Such aircraft are fitted with large water tanks that drop water onto the fire.

13. Design and construction

Many fire appliances around the world are based on standard truck or lorry models, which are upgraded to the specifications required by the purchasing department. In the United States, a majority of fire trucks are specially designed from the chassis to the cab and body. This has led to the use of the term custom fire truck, as opposed to a commercial chassis and cab.

Modifications a fire appliance might undergo include adjustments for higher durability, removal of any speed limiter, and adjustments for long periods of idling at a higher temperature. This may be accomplished by heavy duty suspensions, brakes, tires, alternator, transmission and cooling systems. It is also usual to upgrade the capacity of the electrics of the vehicle, in order to accommodate the use of additional electrical and electronic equipment. Fire appliances have audible and visual warnings, to protect themselves from traffic, and make themselves seen to other units at an incident.

In many countries, use of the audible and visual warnings affords the driver a degree of exemption from road traffic laws (such as the right to exceed speed limits, treat red stop lights as give way etc.) and may also infer a duty on other motorists to move out of the direction of passage of the fire vehicle (or face possible prosecution).

14. Visual warnings

Visual warnings on a fire appliance can be of two types - either passive or active.

14.1. Passive visual warnings

The passive visual warnings involve the use of high contrast patterns. Older vehicles (and those in developing countries) are more likely to have their patterns painted on, whereas modern appliances often carry retro-reflective designs which reflect light from car headlights or torches. Patterns include 'checker board' (alternate coloured squares, sometimes called 'battenburg markings', named after a type of cake), chevrons (arrowheads - often pointed towards the front of the vehicle if on the side, or pointing vertically upwards if on the rear) or stripes (along the side - these were the first type or retro-reflective devices introduced, as the original retro-reflective material came only in tape form). In some countries, in addition to retro-reflective markings, vehicles are now painted a bright yellow or orange, although in many other countries, red remains the colour for fire engines.

Another passive marking is the word FIRE, RESCUE or local language variant spelled out in reverse on the front of the vehicle. This enables drivers of other vehicles to more easily identify an approaching fire service vehicle in their rear view mirrors. The appliance may also display a telephone number which may be used to summon assistance, along with the name of the operating department or station identifier.

14.2. Active visual warnings

The active visual warnings are usually in the form of flashing colouredlights (also known as 'beacons' or 'lightbars'). These flash in order to attract the attention of other road users as the fire appliance approaches, or to provide warning to motorists approaching a stopped appliance in a dangerous position on the road. Common coloursfor fire warning beacons are blue and red. The beacons can be made to flash, the original method was to place a spinning mirror which moves around a light bulb, called a 'rotating beacon'. More modern methods include the use of strobe lights, which are usually brighter, and can be programmed to produce specific patterns (such as a left -> right pattern when parked on the left hand side of the road, indicating to other road users that they should move out away from the vehicle). There is also the more widespread use of LED flashing lights as they are low profile and low energy. More information on Emergency vehicle equipment.

14.3. Audible warnings

In addition to visual warnings, most appliances are also fitted with audible warnings, sometimes known as sirens, which can alert people and vehicles to the presence of an emergency vehicle before they can be seen. The first audible warnings were mechanical bells, mounted to either the front or roof of the truck. Most vehicles are now fitted with electronic sirens, which can produce a range of different noises. Fire service driving training often includes the use of different noises depending on traffic conditions and manoeuvrebeing performed. For instance, on a clear road, approaching a junction, the 'wail' setting may be used, which gives a long up and down variation, with an unbroken tone, whereas, in heavy slow traffic, a 'yelp' setting may be preferred, which is like a wail, but sped up. The speakers for modern sirens can be located in several places on the vehicle, including being integral to the lightbar, or hidden in the grille. Some vehicles may also be fitted with airhorn audible warnings. A number of North American fire departments have returned to the 'acoustic' or 'air' traditional siren as its overtones help the public 'locate' and avoid thefiretruck--the newer electronic signals disperse almost pure tones which are hard to locate, especially in city 'canyons' of buildings.

A development is the use of the RDS system of car radios, whereby the vehicle can be fitted with a short range FM transmitter, set to RDS code 31, which interrupts the radio of all cars within range, in the manner of a traffic broadcast, but in such a way that the user of the receiving radio is unable to opt out of the message (as with traffic broadcasts). This feature is built in to all RDS radios for use in national emergency broadcast systems, but short range units on emergency vehicles can prove an effective means of alerting traffic to their presence, although is not able to alert pedestrians and non-RDS radio users.

15. Additional equipment

Firefighters may also have a range of additional equipment available to them, which may include:

- Two Way Radio - One of the most important pieces of equipment. Many services have moved from traditional UHF/VHF sets, which can be monitored externally, to more secure systems, such as those working on a GSM system, such as TETRA

- Mobile Data Terminal - Many appliances are fitted with Mobile Data Terminals (or MDTs), which are connected wirelessly to a central computer, and enable firefighters to call up details such as incident logs, maps of locations or exclusion zones.
- Evidence gathering CCTV - Some fire vehicles can be fitted with video cameras used to record activity. They may also be fitted with sound recording facilities. This is used for the protection of the crew (and evidence of any assaults or intimidation of the firefighters) or can be used as evidence relating to the incident itself.
- Ramming pads - These rubberised pads are fitted to the chassis of the appliance, to allow the vehicle to be used as a battering ram, or to push other vehicles off the road in an emergency.

16. Crew assignment

Engines are normally staffed with at least three people - an officer, a driver who usually operates the pump, and a firefighter. Preferably, an engine will carry a second firefighter, to increase effectiveness in safely attacking a fire. In some countries, such as Finland, an engine carries the unit leader, an engineer and one or two pairs of firefighters . Since firefighting takes places in a very hot and hostile environment with high risks, fire fighters work as pairs, and at least one more pair of firefighters is needed on scene for the safety and shifting.

In the United Kingdom, firefighters are arranged in fire and rescue services - historically known as brigades, and usually organised at county, city or combined level. These are divided into either commands or areas, in some cases divisions, then stations, which range in size but in almost every instance have at least one pumping appliance. In addition, general purpose engine stations may have specialist vehicles such as turntable ladders, hydraulic platforms, foam tenders, etc. The number of personnel at a station varies depending on the number of applainces, and whether it is full time, day manned or retained. Generally, the crew of an average sized pump is around 5, but in any case it can be no less than four and no more than six.

In cities of the United States, firefighters are generally deployed into fire companies specializing in certain tasks. Most common are engine companies and ladder, or "truck", companies. In addition, large cities frequently staff rescue companies. By definition, each company is led by an officer (a captain or lieutenant) who commands several firefighters. Staffing of fire companies varies by jurisdiction and frequently by company type. In large cities, fire company staffing may vary from as few as three to as many as six personnel. In

suburban and rural areas of the United States, the legal organization to which volunteers belong is usually called a company; one company may operate several pieces of apparatus. Duties of volunteers are often less specialized than those of city firefighters, because it is less predictable who will be available for a given emergency, so more flexibility is needed.

In New Zealandthe standard crew consists of four - the OIC, driver and two others. They are numbered OIC,1,2 and 3, with the OIC in the front passengers seat and number 1 directly behind them. number 3 is the driver. The crew has specific tasks in a water drill, decided by where they are sitting. At call-outs, there may be five on an appliance,

In Section 3 of this course you will cover these topics:

- Organization And Administration Of Municipal Fire Prevention Units
- Instilling Positive Fire Reaction
- Fire Prevention Efforts Of The Private Sector

Topic Objective:

- Organizing
- Coordination
- Officer Commanding
- Work specialization
- Chain of command
- Authority, responsibility, and accountability
- Delegation
- Line and staff authority
- Span of management
- Centralisation, decentralisation, and formalization
- Importance of organising
- Cooperation vs. competition
- The Prisoner's Dilemma
-

Definition/Overview:

Organizing: Organizing is the act of rearranging elements following one or more rules.

Coordination: Coordination is the act of coordinating, making different people or things work together for a goal or effect.

Officer Commanding: The Officer Commanding (OC) is the commander of a sub-unit or minor unit (smaller than battalion size) in widespread military usage.

Key Points:

1. **Officer Commanding**

Normally an Officer Commanding is a company, squadron or battery commander (typically a Major). However, the commanders of independent units of smaller than company size, detachments and administrative organisations, such as schools or wings, may also be designated Officers Commanding.

The term Officer Commanding cannot be applied to any officer who is given command of a minor unit. For example, a platoon commander whose platoon is part of a company would not be an Officer Commanding. The Officer Commanding with power over that platoon would be the company OC. Officer Commanding is an appointment that confers a level of additional powers and responsibilities on the appointee.

Officers Commanding are generally given the same power and responsibilities as Commanding Officers of battalions and regiments. They are held responsible for the unit's properties and monies, can hear disciplinary charges against soldiers, sailors, or airmen under their command, and can delegate these powers.

2. Applications

Organizing, in companies point of view, is the management function that usually follows after planning. And it involves the assignment of tasks, the grouping of tasks into departments and the assignment of authority and allocation of resources across the organization.

3. Structure

The framework in which the organization defines how tasks are divided, resources are deployed, and departments are coordinated.

- A set of formal tasks assigned to individuals and departments.
- Formal reporting relationships, including lines of authority, decision responsibility, number of hierarchical levels and span of managers control.
- The design of systems to ensure effective coordination of employees across departments.

4. Work specialization

The degree to which organizational tasks are sub divided into individual jobs; also called division of labour. With too much specialization, employees are isolated and do only a single, tiny, boring job. Many organizations enlarge jobs to provide greater challenges or assigning to tasks that are rotated.

5. Chain of command

An unbroken line of authority that links all individuals in the organization and specifies who reports to whom.

- Unity of Command - one employee is held accountable to only one supervisor
- Scalar principle - clearly defined line of authority in the organization that includes all employees.

6. Authority, responsibility, and accountability

6.1.Authority

Formal and legitimate right of a manager to make decisions, issue orders, and allocate resources to achieve organizationally desired outcomes.

6.2.Responsibility

Responsibility is define as the duty to perform the task or activity an employee has been assigned

6.3.Accountability

Accountability is the fact that the people with authority and responsibility are subject to reporting and justifying task outcomes to those above them in the chain of command

7. Delegation

The process managers use to transfer authority and responsibility to positions below them in the hierarchy.Organisations today tend to encourage delegation from highest to lowest possible levels. Can improve flexibility to meet customers needs and adaptation to competitive environments. Managers often find delegation difficult.

8. Line and staff authority

8.1.Line authority

It is the authority in which individuals in management positions have the formal power to direct and control immediate subordinates.

8.2.Staff authority

This authority granted to staff specialists in their areas of expertise. Narrower than line authority and includes the right to advise, recommend, and counsel in the staff specialists' area of expertise. It is a communication relationship with management.

9. Span of management

Factors influencing larger span of management

- Work performed by subordinates is stable and routine.
- Subordinates perform similar work tasks.
- Subordinates are concentrated in a single location.
- Subordinates are highly trained and need little direction in performing tasks.
- Rules and procedures defining task activities are available.
- Support systems and personnel are available for the managers.
- Little time is required in nonsupervisory activities such as coordination with other departments or planning.

- Managers' personal preferences and styles favour a large span.

10. Tall versus flat structure

10.1. Tall

A management structure characterised by an overall narrow span of management and a relatively large number of hirarchicallevels. Tight control.

10.2. Flat

A management structure characterised by a wide span of control and relatively few hirarchical levels. Loose control. Facilitates delegation.

11. Centralisation, decentralisation, and formalization

11.1. Centralisation

The location of decision making authority near top organisationallevels.

11.2. Decentralisation

The location of decision making authority near lower organisationallevels.

11.3. Formalisation

The written documentation used to direct and control employees.

12. Departmentalization

The basis on which individuals are grouped into departments and departments into total organisations. Approach options include;

- Functional - by common skills and work tasks
- Divisional - common product, programme or geographical location
- Matrix - combination of Functional and Divisional
- Team - to accomplish specific tasks
- Network - departments are independent providing functions for a central core breaker

13. Importance of organising

Organisationsare often troubled by how to organise, particularly when a new strategy is developed. Changing market conditions or new technology requires change. Organisations seek efficiencies through improvements in organizing

14. Cooperation vs. competition

While cooperation is the antithesis of competition, the need or desire to compete with others is a common impetus that motivates individuals to organize into a group and cooperate with each other in order to form a stronger competitive force.

Cooperation in many areas, such as farming and housing, may be in the form of a cooperative or, alternately, in the form of a conventional business. Many people resort to this because, they may cooperate by trading with each other or by altruistic sharing.

Certain forms of cooperation are illegal in some jurisdictions because they alter the nature of access by others to economic or other resources. Thus, cooperation in the form of cartels or price-fixing may be illegal. A few mechanisms have been suggested for the appearance of cooperation between humans or in natural system

15. The Prisoner's Dilemma

Even if all members of a group would benefit if all cooperate, individual self-interest may not favor cooperation. The prisoner's dilemma codifies this problem and has been the subject of much research, both theoretical and experimental. Results from experimental economics show that humans often act more cooperatively than strict self-interest would seem to dictate.

One reason for this may be that if the prisoner's dilemma situation is repeated (the iterated prisoner's dilemma), it allows non-cooperation to be punished more, and cooperation to be rewarded more, than the single-shot version of the problem would suggest. It has been suggested that this is one reason for the evolution of complex emotions in higher life forms, who, at least as infants, and usually thereafter, cannot survive without cooperating - although with maturation they gain much more choice about the kinds of cooperation they wish to have. There are four main conditions that tend to be necessary for cooperative behaviourto develop between two individuals:

- An overlap in desires
- A chance of future encounters with the same individual
- Memory of past encounters with that individual
- A value associated with future outcomes

Topic Objective:

- Fire safety
- Fire code
- Fire safety education
- Target Audiences
- Current Life safetycode
- Components
- Balanced Approach
- Common items to check for to avoid systemic problems

Definition/Overview:

Structural fire protection: Fire prevention includes minimizing ignition sources, as well as educating the occupants and operators of the facility, ship or structure concerning operation and maintenance of fire related systems for correct function, and emergency procedures including notification for fire service response and emergency evacuation.

Fire protection: Fire protection is the safety and of the hazards associated with fires. It involves the study of the behaviour,compartmentalisation, suppression and investigation of fire and its related emergencies as well as the research and development, production, testing and application of mitigating systems.

Key Points:

1. Fire safety

Fire safety refers to precautions that are taken to prevent or reduce the likelihood of a fire that may result in death, injury, or property damage, alert those in a structure to the presence of a fire in the event one occurs, better enable those threatened by a fire to survive, or to reduce the damage caused by a fire. Fire safety measures include those that are planned during the construction of a building or implemented in structures that are already standing, and those that are taught to occupants of the building.

Threats to fire safety are referred to as fire hazards. A fire hazard may include a situation that increases the likelihood a fire may start or may impede escape in the event a fire occurs. Fire safety is often a component of building safety. Those who inspect buildings for violations of the Fire Code and go into schools to educate children on Fire Safety topics are fire department members known as fire prevention officers. The Chief Fire Prevention Officer or Chief of Fire Prevention will normally train newcomers to the Fire Prevention Division and may also conduct inspections or make presentations.

2. Fire code

The Fire code (also Fire prevention code or Fire safety code) is a model code adopted on a regional basis and enforced by fire prevention officers within municipal fire departments. It is a set of rules prescribing minimum requirements to prevent fire and explosion hazards arising from storage, handling, or use of dangerous materials, or from other specific hazardous conditions and complements the building code. The fire code is aimed primarily at preventing fires, ensuring that necessary training and equipment will be on hand, and the design basis of the building, including a basic plan set out by the architect, is not compromised. The fire code also addresses inspection and maintenance requirements of various fire protection equipment in order to maintain optimal active fire protection and passive fire protection measures, with the products used in accordance with their certification listing.

A typical fire safety code includes administrative sections about the rule-making and enforcement process, and substantive sections dealing with fire suppression equipment,

particular hazards such as containers and transportation for combustible materials, and specific rules for hazardous occupancies, industrial processes, and exhibitions.

Sections may lay out the requirements for obtaining permits and specific precautions required to remain in compliance with a permit. For example, a fireworks exhibition may require an application to be filed by a licensed pyrotechnician, providing the information necessary for the issuing authority to determine whether safety requirements can be met. Once a permit is issued, the same authority (or another delegated authority) may inspect the site and monitor safety during the exhibition, with the power to halt operations, when unapproved practices are seen or when unforeseen hazards arise.

3. Fire safety education

All fire authorities have a fire safety education program and one of the functions of Fire Prevention Officers is to visit schools to educate the children both in how to prevent fires and the actions they should take in the event of a fire occurring.

Fire prevention programs may include distribution of smoke detectors, visiting schools to review key topics with the students and implementing nationally recognized programs such as NFPAs "Risk Watch" & "Learn not to burn."

Other programs or props can be purchased readily by fire departments or community organizations. Notably, these are usually entertaining, capture children's attention and relay important messages. Such props include types that are mostly auditory, such as puppets & robots. The prop is visually stimulating but the safety message is only transmitted orally. Other props are more elaborate, access more senses and increase the learning factor. They mix audio messages and visual queues as well as hands-on interaction. Examples of these include mobile trailer safety houses and tabletop hazard house simulators.

All programs tend to mix messages of general injury prevention, safety, fire prevention and escape in case of fire. In most cases the fire department representative is regarded as the expert and is expected to present information in a manner that is appropriate for each age group.

4. Target Audiences

In the United States, the very young and the elderly are considered to be "at risk" populations. These two groups represent approximately 33% of the population and are targeted to receive fire safety information.

5. Current Life safety code

The Life Safety Code is unique among most codes in that it applies to existing structures as well as new structures. When a Code revision is adopted into local law, existing structures have a grace period before they must comply, but all structures must comply with code.

All or part of a code may be adopted as regulations in a jurisdiction and enforced by an inspector, zoning board, fire marshal, or other officials. In particular, the Life Safety Code deals with hazards in buildings, public conveyances and occupations, and are coordinated with other codes and standards such as electrical, fuel-gas, mechanical, plumbing, energy, and residential. Regardless of official adoption as regulations, life safety code provides a valuable source for determination of liability in accidents, and many codes and related standards are sponsored by insurance companies.m Although life safety codes deal mainly with hazards in buildings, they also cover other emergencies that are similar to fire and are applied to vehicles, vessels and other transports since these objects are treated as buildings for life safety purposes.

The Life Safety Code is coordinated with other building codes and standards such as electrical (National Electric Code NFPA70), fuel-gas, mechanical, plumbing, energy, and residential. Normally, the Life Safety Code is used by architects and designers of vehicles and vessels. Since the Life Safety Code is a valuable source for determining liability in accidents, it is also used by insurance companies to evaluate risks and set rates. In the United States, the words Life Safety Code are a registered trademark of NFPA. All or part of the NFPA'sLife Safety Code are adopted as local regulations throughout the country. The compliance with the Code is enforced by inspectors from local zoning boards, fire departments, or other bodies having jurisdiction

6. Components

Structural fire protection (in land-based buildings, offshore construction or onboard ships) is typically achieved via three means:

6.1.Passive fire protection

Passive fire protection (use of integral, fire-resistance rated wall and floor assemblies that are used to form fire compartments intended to limit the spread of fire, or occupancy separations, or firewalls, to keep fires, high temperatures and flue gases within the fire compartment of origin, thus enabling firefighting and evacuation)

6.2.Active fire protection

Active fire protection (manual and automatic detection and suppression of fires, as in using and installing a Fire Sprinkler system or finding the fire (Fire alarm) and/or extinguishing it)

6.3.Education

Education (ensuring that building owners and operators have copies and a working understanding of the applicable building and fire codes, having a purpose-designed fire safety plan and ensuring that building occupants, operators and emergency personnel know the building, its means of Active fire protection and Passive fire protection, its weak spots and strengths to ensure the highest possible level of safety)

7. Balanced Approach

Passive fire protection (PFP) in the form of compartmentalisation was developed prior to the widespread use of active fire protection (AFP), mainly in the form of fire sprinklers. During this time, PFP was the dominant mode of protection provided in facility designs. With the widespread installation of fire sprinklers in the past 50 years, the reliance on PFP as the only approach was reduced. There is a perception by some fire protection engineers and some members of the fire protection construction industry that the model building codes have changed with too much reliance on AFP.

Lobby groups are typically divided into two camps favouring active or passive fire protection. Each camp tries to garner more business for itself through its influence in establishing or changing local and national building and fire codes. At present, the camp favouring AFP appears to be leading.

A balanced approach between all three parts, Education, AFP and PFP, is generally recognisedto be the best overall approach, but there are disagreements in emphasis. This is to be expected, considering that many of the proponents of one camp or another have a vested interest in the outcome, as they are involved in the sales or construction of one of the systems. Many insiders in the trade, who know how much field conditions can influence matters, conclude that no one side has all the answers.

The relatively recent inclusion of performance based or objective based codes tend to support AFP initiatives, and can lead to the justification for less substantial construction. Some proponents of PFP feel that this new approach is not properly balanced, as the use of automatic suppression with codes allowing performance based designs often favours the cost savings resulting from less solid structures. At times it works the other way around, as firewalls that protrude through the roof structure are used to "sub-divide" buildings such that the separated parts do not require sprinklers.

The decision to favourAFP versus PFP in the design of a new building may be affected by the lifecycle costs. Lifecycle costs can be shifted from capital to operational budgets and vice versa. AFP, may initially require less capital to install, but due to its nature requires significant operational resources to maintain. PFP on the other hand, may be more costly to install but less costly to maintain. Planners consider the expected life expectancy of a building to make the most beneficial long term decision.

8. Common items to check for to avoid systemic problems

In compliance with the local building code and fire code, the architect and his other consultants typically outline the basic fire protection plan for a building. When applications for a building permit are made, this plan then becomes known to the Authority Having Jurisdiction (AHJ). If accepted by the AHJ, a permit is issued. Deviations from that original plan, should be made known to the AHJ to make sure that the change is still in compliance with the law. For existing buildings, this means that changes are to be approved through the

permit regime, even though the structure already exists. The City of Toronto, for instance, publishes a list of items to tell interested parties when a permit is required. Torontoalso indicates when a permit is not required. The idea behind this is to catch and prevent any unsafe conditions that may violate the law and put people at risk. For fire protection, this means that if any one of the three components of Fire Protection fail, the fire safety plan can be immediately and severely compromised. Examples of code violations can be seen here. For example, if the firestop systems in a structure were inoperable, a significant part of the fire safety plan would not work in the event of a fire because the walls and floors that contain the firestopsare intended to have a fire-resistance rating, which has been achieved through passing a fire test and, often, product certification of the components involved in the construction of those walls and floors.

It is a physical impossibility to pass a fire test, that demands that the wall or floor in question not permit the passage of fire, when there is a hole in it to let the fire through or when that hole develops before the fire-resistance duration period for the subject barrier is elapsed. Therefore, an improperly sealed or an unsealed penetration such as this removes the rating of the wall or floor it is in. If that wall or floor performs a structural function as well as forming part of an area of refuge, for instance, it is easy to see why this violation can have a cumulative effect, which is why municipalities use the permit process and on-site inspections to minimise the risk to the public. Since the overall plan depends on all pieces, it is important to see that each item is in fact functional. Likewise, if there were a sprinkler system or an alarm system, but it's down for lack of knowledgeable maintenance, or if building occupants prop open a fire door and then run a carpet through, the likelihood of damage and casualties is markedly increased. It is vital for everyone to realise that fire protection within a structure is a system that relies on all of its components

Topic Objective:

- Basis Incidents
- Events
- Clear Text (Common Terminology)
- Management by Objective
- Flexible/Modular Organization
- Span-of-control
- Coordination

- Incident Action Plan
- Comprehensive Resource Management
- Integrated Communications
- Incident Commander
- Command Staff
- General Staff
- Facilities
- Incident Command Post (ICP)
- Multiple AgencyCoordination Center (MACC)
- Equipment
- Type and kind
- Command transfer

Definition/Overview:

Incident Command System: The Incident Command System (ICS) is a standardized, on-scene, all-hazard incident management concept in the United States. It is a management protocol originally designed for emergency management agencies and later federalized. ICS is based upon a flexible, scalable response organization providing a common framework within which people can work together effectively. These people may be drawn from multiple agencies that do not routinely work together, and ICS is designed to give standard response and operation procedures to reduce the problems and potential for miscommunication on such incidents. ICS has been summarized as a "first-on-scene" structure, where the first responder on a scene has charge of the scene until the incident is resolved or the initial responder transitions incident command to an arriving, more-qualified individual.

Key Points:

1. Basis Incidents

Incidents are defined within ICS as unplanned situations necessitating a response. Examples of incidents may include:

- Any emergency medical situation (ambulance service)

- A Hazardous Materials spill
- Terrorist attacks
- Natural disasters such as wildfires, flooding, earthquake or tornado
- Man-made disasters such as vehicle crashes, industrial accidents, train derailments, or structural fires
- Search and Rescue operations

2. Events

Events are defined within ICS as planned situations. Incident command is increasingly applied to events both in emergency management and non-emergency management settings. Examples of events may include:

- Concerts
- Parades and other ceremonies
- Fairs and other gatherings
- Training exercises
- Foundations

Unity of Command means that each individual participating in the operation reports to only one supervisor. This eliminates the potential for individuals to receive conflicting orders from a variety of supervisors, thus increasing accountability, preventing freelancing, improving the flow of information, helping with the coordination of operational efforts, and enhancing operational safety.

3. Clear Text (Common Terminology)

Clear Text (Common terminology) describes the format and phrasing of all incident communications. As an emergency response organization is often made of individuals who normally do not work together as a team, when they come together the use of common terminology is viewed as an essential element in team building and communications, both internally and with other organizations responding to the incident. The Incident Command System promotes the use of common terminology, and has an associated glossary of terms that help bring consistency to position titles, the description of resources and how they can be organized, the type and names of incident facilities, and a host of other subjects. The most

apparent implementation of this concept is in radio communication; 10-codes (e.g. "10-4" to mean "I understand"), acronyms, and potentially arcane abbreviations are not to be used on the radio. Radio prowords (e.g. "Wilco" to mean "I understand and will comply") are generally accepted due to their universality.

4. Management by Objective

Management by Objective is the heart of management planning. In principle, all actions at an incident should be directed toward satisfying a major goal of the incident. The Incident Commander and Planning Section are responsible for the development of strategic objectives that clearly define what the incident team is working to achieve during operations. Based upon the information presented at the initial incident planning meeting and the analysis of incident potential and impacts, the Incident Commander and Section Chiefs should have a clear understanding of the major goals that need to be completed. Objectives are usually written, and any event with a written Incident Action Plan must have the objectives included in that written plan.

5. Flexible/Modular Organization

Flexible/Modular Organization describes the ability of an Incident Command structure to expand and contract efficiently as needed by the incident scope or available personnel. Only positions that are required for an adequate response should be filled, and ICS sections are kept as small as possible to accomplish incident objectives and monitor progress, within effective span-of-control. The level of response necessary for a specific incident dictates how and when the organization develops, and in many instances not all sections need to be activated. Only in the largest and most complex operations would the full ICS organization be staffed.

6. Span-of-control

Span-of-control is the most fundamentally important management principle of ICS. It applies to the management of individual responsibilities and response resources. The objective is to limit the number of responsibilities being handled by, and the number of resources reporting directly to, an individual. ICS considers that any single person's span of control should be

between three and seven, with five being ideal. In other words, one manager should have no more than seven people working under them at any given time.

When span-of-control problems arise around an individual's ability to address responsibilities, they can be addressed by expanding the organization in a modular fashion. This can be accomplished in a variety of ways. An Incident Commander can delegate responsibilities to a deputy and/or activate members of the Command Staff. Members of the Command Staff can delegate responsibilities to Assistants, etc. There may be exceptions, usually in lower-risk assignments or where resources work in close proximity to each other.

7. Coordination

Coordination on any incident or event is possible and effective due to the implementation of the following concepts:

8. Incident Action Plan

Incident Action Plans include the measurable strategic operations to be achieved and are prepared around a time frame called an Operational Period. Incident Action Plans may be verbal or written (except for hazardous material incidents where it has to be written), and are prepared by the Planning Section. The IAP insures that everyone is working in concert toward the same goals set for that operational period. The purpose of this plan is to provide all incident supervisory personnel with direction for actions to be implemented during the operational period identified in the plan. Incident Action Plans provide a coherent means of communicating the overall incident objectives in the context of both operational and support activities. The consolidated IAP is a very important component of the ICS that reduces freelancing and ensures a coordinated response. At the simplest level, all Incident Action Plans must have four elements:

- What do we want to do?
- Who is responsible for doing it?
- How do we communicate with each other?
- What is the procedure if someone is injured?

9. Comprehensive Resource Management

Comprehensive Resource Management is a key management principle that implies that all assets and personnel during an event need to be tracked and accounted for. It can also include processes for reimbursement for resources, as appropriate. Resource management includes processes for:

- Categorizing resources.
- Ordering resources.
- Dispatching resources.
- Tracking resources.
- Recovering resources.

Comprehensive Resource Management ensures that visibility is maintained over all resources so they can be moved quickly to support the preparation and response to an incident, and ensuring a graceful demobilization. It also applies to the classification of resources by type and kind, and the categorization of resources by their status. Assigned resources are those that are working on a field assignment under the direction of a supervisor. Available resources are those that are ready for deployment, but have not been assigned to a field assignment.

Out-of-service resources are those that are not in either the " available" or "assigned" categories. Resources can be "out-of-service" for a variety of reasons including: resupplying after a sortie (most common), shortfall in staffing, personnel taking a rest, damaged/inoperable.

10. Integrated Communications

The use of a common communications plan is essential for ensuring that responders can communicate with one another during an incident. Communication equipment, procedures, and systems must operate across jurisdictions (interoperably). Developing an integrated voice and data communications system, including equipment, systems, and protocols, must occur prior to an incident.

11. Incident Commander

11.1. Single Incident Commander

Most incidents involve a single Incident Commander. In these incidents a single person commands the incident response and is the decision-making final authority.

11.2. Unified Command

A Unified Command is used on larger incidents usually when multiple agencies are involved. A Unified Command typically includes a command representative from major involved agencies and one from that group to act as the spokesman, though not designated as an Incident Commander. A Unified Command acts as a single entity.

11.3. Area Command

During multiple-incident situations, an Area Command may be established to provide for Incident Commanders at separate locations. Generally, an Area Commander will be assigned - a single person - and the Area Command will operate as a logistical and administrative support. Area Commands usually do not include an Operations function.

12. Command Staff

12.1. Safety Officer

The Safety Officer monitors safety conditions and develops measures for assuring the safety of all assigned personnel.

12.2. Public Information Officer

The Public Information Officer serves as the conduit for information to internal and external stakeholders, including the media or other organizations seeking information directly from the incident or event.

12.3. Liaison

A Liaison serves as the primary contact for supporting agencies assisting at an incident.

13. General Staff

13.1. Operations Section Chief

The Operations Section Chief is tasked with directing all actions to meet the incident objectives.

13.2. Planning Section Chief

The Planning Section Chief is tasked with the collection and display of incident information, primarily consisting of the status of all resources and overall status of the incident.

13.3. Finance/Administration Section Chief

The Finance/Admin. Section Chief is tasked with tracking incident related costs, personnel records, requisitions, and administrating procurement contracts required by Logistics.

13.4. Logistics Section Chief

The Logistics Section Chief is tasked with providing all resources, services, and support required by the incident.

14. Facilities

ICS uses a standard set of facility nomenclature. ICS facilities include: Pre-Designated Incident Facilities: Response operations can form a complex structure that must be held together by response personnel working at different and often widely separate incident facilities. These facilities can include:

15. Incident Command Post (ICP)

The ICP is the location where the Incident Commander operates during response operations. There is only one ICP for each incident or event, but it may change locations during the event. Every incident or event must have some form of an Incident Command Post. The ICP may be located in a vehicle, trailer, tent, or within a building. The ICP will be positioned outside of the present and potential hazard zone but close enough to the incident to maintain command. The ICP will be designated by the name of the incident, e.g., Trail Creek ICP.

15.1. Staging Area

Can be a location at or near an incident scene where tactical response resources are stored while they await assignment. Resources in staging area are under the control of the Logistics Section and are always in available status. Staging Areas should be located close enough to the incident for a timely response, but far enough away to be out of the immediate impact zone. There may be more than one Staging Area at an incident. Staging Areas can be collocated with the ICP, Bases, Camps, Helibases, or Helispots.

15.2. Base

A Base is the location from which primary logistics and administrative functions are coordinated and administered. The Base may be collocated with the Incident Command Post. There is only one Base per incident, and it is designated by the incident name. The Base is established and managed by the Logistics Section. The resources in the Base are always out-of-service.

15.3. Camps

Locations, often temporary, within the general incident area that are equipped and staffed to provide sleeping, food, water, sanitation, and other services to response personnel that are too far away to use base facilities. Other resources may also be kept at a camp to support incident operations if a Base is not accessible to all resources. Camps are designated by geographic location or number. Multiple Camps may be used, but not all incidents will have Camps.

15.4. Helibase

A Helibase is the location from which helicopter-centered air operations are conducted. Helibases are generally used on a more long-term basis and include such services as fueling and maintenance. The Helibase is usually designated by the name of the incident, e.g. Trail Creek Helibase.

15.5. Helispots

Helispots are more temporary locations at the incident, where helicopters can safely land and take off. Multiple Helispotsmay be used.

Each facility has unique location, space, equipment, materials, and supplies requirements that are often difficult to address, particularly at the outset of response operations. For this reason, responders should identify, pre-designate and pre-plan the layout of these facilities, whenever possible. On large or multi-level incidents, higher-level support facilities may be activated.

16. Multiple Agency CoordinationCenter (MACC)

Also known as an Emergency OperationsCenter, the MACC is a central command and control facility responsible for the strategic, or "big picture" of the disaster. Personnel within the MACC use Multi-agency Coordination to guide their operations. The MACC coordinates activities between multiple agencies and does not normally directly control field assets, but makes strategic decisions and leaves tactical decisions to individual agencies. The common functions of all EOC'sis to collect, gather and analyze data; make decisions that protect life and property, maintain continuity of the government or corporation, within the scope of applicable laws; and disseminate those decisions to all concerned agencies and individuals.

17. Equipment

ICS uses a standard set of equipment nomenclature. ICS equipment include:

Tanker - This is an aircraft that carries fuel (Fuel Tanker) or water (Water Tanker).

Tender - Like a tanker, but a ground vehicle, also carrying fuel (Fuel Tender) or water (Water Tender).

18. Type and kind

The "type" of resource describes the size or capability of a resource. For instance, a 50 kW (for a generator) or a 3-ton (for a truck). Types are designed to be categorized as "Type 1" through "Type 5" formally, but in live incidents more specific information may be used. The "kind" of resource describes what the resource is. For instance, generator or a truck. The "type" of resource describes a performance capability for a kind of resource for instance,

In both type and kind, the objective must be included in the resource request. This is done to widen the potential resourse response. As an example, a resource request for a small aircraft for arialreconnaissance of a search and rescue scene may be satisfied by a National Guard OH-58 Kiowa helicopter (Type & Kind: Rotary-wing aircraft, Type II/III) or by a Civil Air Patrol Cessna 182 (Type & Kind: Fixed-wing aircraft, Type I). In this example, requesting only a fixed-wing or a rotary-wing, or requesting by type may prevent the other resource's availability from being known.

19. Command transfer

A role of responsibility can be transferred during an incident for several reasons: As the incident grows a more qualified person is required to take over as Incident Commander to handle the ever-growing needs of the incident, or in reverse where as an incident reduces in size command can be passed down to a less qualified person (but still qualified to run the now-smaller incident) to free up highly-qualified resources for other tasks or incidents. Other reasons to transfer command include jurisdictional change if the incident moves locations or area of responsibility, or normal turnover of personnel due to extended incidents. The transfer of command process always includes a transfer of command briefing, which may be oral, written, or a combination of both

In Section 4 of this course you will cover these topics:

- Fire Prevention Responsibilities Of The Public Sector
- Fire Prevention Through Arson Suppression
- International Practices In Fire Prevention

Topic Objective:

- Occupancy
- Building code
- Firestops
- Building utilisation
- Fire protection
- Building Operation in conformance with Design
- Fireproofing
- Building construction

Definition/Overview:

Occupancy: Occupancy is a defined legal term in building construction and building codes. It refers to the use or intended use of a building or part thereof for the shelter or support of persons, animals or property. A closely-related meaning is the number of units in such a building that are rented or leased, or otherwise in-use. The lack of occupancy in this sense is a vacancy.

Key Points:

1. Occupancy

Occupancy is a defined legal term in building construction and building codes. It refers to the use or intended use of a building or part thereof for the shelter or support of persons, animals or property. A closely-related meaning is the number of units in such a building that are rented or leased, or otherwise in-use. The lack of occupancy in this sense is a vacancy.

2. Building code

It is possible to have multiple occupancies (or building uses) within one building. For instance, one may have a high-rise building, where the lower levels are occupied by retail stores, whereas the upper levels could be residential.

Different occupancies within one building are separated by a fire barrier with a defined fire-resistance rating. It is common for a penetration, such as a fire door, to have a fire protection

rating lower than the wall fire resistance rating in which it is installed. For example, a two-hour fire separation normally requires fire doors rated at 90-minutes.

For some high challenge occupancies the code requirements for an occupancy separation are more stringent than for other fire-barriers, even with an identical fire-resistance rating. In this case, an occupancy separation with a two-hour fire-resistance rating may not be able to de-rate its closures, such fire doors or firestops. For example, a two-hour rated high challenge fire wall requires 2 hr rated fire doors.

3. Firestops

Firestopsin occupancy separations are also more likely to be required not only an equal fire protection rating (a fire-resistance rating for closures) but must also provide a temperature rating, such that the components of the firestop systems, including the penetrants, are not permitted to rise in temperature above 140C (284F) on average or 180C (356F) on any single point, so as to lower the likelihood of auto-ignition on the unexposed side. In this manner, occupancy separations are treated similarly to fire walls, which are structurally stable in case of a fire, limiting fire-induced building collapse.

In this sense, there are two occupancies in most single-family homes: the garage and the living space of the home. Because automobile gasoline or petrol is flammable, an occupancy separation is often required between the two, should there be a vehicle fire. Water heaters and central heating are often placed in this space as well, for their use of natural gas, propane, or other fossil fuels in combustion. This also helps to prevent carbon monoxide poisoning.

4. Building utilisation

Occupancy can also refer to the number of units in use, such as hotel rooms, apartment flats, or offices. When a motel is at full (100%) occupancy, a NO VACANCY neon sign is often turned on (though the sign often still says VACANCY at other times). Office buildings and apartments in particular aim for full occupancy, but if too many are built in an area this is often not the case. Completely vacant buildings can also attract crime, and are eventually targeted for redevelopment or at least renovation.

Occupancy can also mean the number of persons using an undivided space, such as a meeting room, ballroom, auditorium, or stadium. As with building codes, fire-protection authorities often set a limit on the number of people that can occupy a space, primarily because they must be able to leave the building through the available number of exits in a reasonable amount of time, without tripping or trampling each other in a panicked stampede, possibly blinded by smoke. The integrity of a structure may also be at stake, because too many people will put excessive weight and other forces, leading in some cases to a collapse. An occupancy sensor is a device that can tell if someone is in a room, and is often used in home automation and security systems. These are typically more advanced than motion sensors, which can only detect motion.

5. Fire protection

Fire protection is the study and practice of mitigating the unwanted effects of fires. It involves the study of the behaviour, compartmentalisation, suppression and investigation of fire and its related emergencies, as well as the research and development, production, testing and application of mitigating systems. In structures, be they land-based, offshore or even ships, the owners and operators are responsible to maintain their facilities in accordance with a design-basis that is rooted in laws, including the local building code and fire code, which are enforced by the Authority Having Jurisdiction. Buildings must be constructed in accordance with the version of the building code that is in effect when an application for a building permit is made. Building inspectors check on compliance of a building under construction with the building code. Once construction is complete, a building must be maintained in accordance with the current fire code, which is enforced by the fire prevention officers of a local fire department. In the event of fire emergencies, Firefighters, fire investigators, and other fire prevention personnel called to mitigate, investigate and learn from the damage of a fire. Lessons learned from fires are applied to the authoring of both building codes and fire codes. In the United States, this term is used by engineers and code officials when referring only to active and passive fire protection systems, and does usually not encompass fire detection systems such as fire alarms or smoke detection.

6. Building Operation in conformance with Design

The building is designed in compliance with the local building code and fire code by the architect and other consultants. A building permit is issued after review by the Authority

Having Jurisdiction (AHJ). Deviations from that original plan should be made known to the AHJ to make sure that the change is still in compliance with the law to prevent any unsafe conditions that may violate the law and put people at risk. For example, if the firestop systems in a structure were inoperable, a significant part of the fire safety plan would not work in the event of a fire because the walls and floors that contain the firestops are intended to have a fire-resistance rating, which has been achieved through passing a fire test and, often, product certification of the components involved in the construction of those walls and floors. Likewise, if the sprinkler system or fire alarm system is is inoperable for lack of knowledgeable maintenance, or if the building occupants prop open a fire door and then run a carpet through, the likelihood of damage and casualties is increased. It is vital for everyone to realise that fire protection within a structure is a system that relies on all of its components.

7. Fireproofing

Fireproofing, a passive fire protection measure, refers to the act of making materials or structures more resistant to fire, or to those materials themselves, or the act of applying such materials. Applying a certification listed fireproofing system to certain structures allows these to have a fire-resistance rating. The term fireproof does not necessarily mean that an item cannot ever burn: It relates to measured performance under specific conditions of testing and evaluation. Fireproofing does not allow treated items to be entirely unaffected by any fire, as conventional materials are not immune to the effects of fire at a sufficient intensity and/or duration.

8. Building construction

Building construction is the process of adding structure to real property. The vast majority of building construction projects are small renovations, such as addition of a room, or renovation of a bathroom. Often, the owner of the property acts as laborer, paymaster, and design team for the entire project. However, all building construction projects include some elements in common - design, financial, and legal considerations. Many projects of varying sizes reach undesirable end results, such as structural collapse, cost overruns, and/or litigation reason, those with experience in the field make detailed plans and maintain careful oversight during the project to ensure a positive outcome.

Building construction is procured privately or publicly utilizing various delivery methodologies, including hard bid, negotiated price, traditional, management contracting, construction management-at-risk, design & build and design-build bridging.

Residential construction practices, technologies, and resources must conform to local building authority regulations and codes of practice. Materials readily available in the area generally dictate the construction materials used (e.g. brick versus stone, versus timber). Cost of construction on a per square metre(or per square foot) basis for houses can vary dramatically based on site conditions, local regulations, economies of scale (custom designed homes are always more expensive to build) and the availability of skilled tradespeople. As residential (as well as all other types of construction) can generate a lot of waste, careful planning again is needed here.

The most popular method of residential construction in the United States is wood framed construction. As efficiency codes have come into effect in recent years, new construction technologies and methods have emerged. University Construction Management departments are on the cutting edge of the newest methods of construction intended to improve efficiency, performance and reduce construction waste.

Building construction is the process of adding structure to real property. The vast majority of building construction projects is small renovations, such as addition of a room, or renovation of a bathroom. Often, the owner of the property acts as laborer, paymaster, and design team for the entire project. However, all building construction projects include some elements in common - design, financial, and legal considerations. Many projects of varying sizes reach undesirable end results, such as structural collapse, cost overruns, and/or litigation reason; those with experience in the field make detailed plans and maintain careful oversight during the project to ensure a positive outcome.

Building construction is produced privately or publicly utilizing various delivery methodologies including hard-bid, negotiated price, traditional management-at-risk design build and design build bridging

Topic Objective:

Key Points:

1.Common law

Arson (or fire-raising, as it is known in Scotland) is defined as "the malicious burning of the dwelling of another" " in common law. The prosecutor must prove each element of the crime beyond a reasonable doubt. Arson was punished at common law as a felony in the eighteenth century. The destruction of an unoccupied building was not considered as arson, "[s]ince arson protected habitation, the burning of an unoccupied house did not constitute arson." Furthermore, "[t]he burning of one's own dwelling to collect insurance did not constitute common law arson. It was generally assumed in early Englandthat one had the legal right to destroy his own property in any manner he chose."

2.United States

In the U.S., the common law elements of arson are often varied in different jurisdictions. For example, the element of "dwelling" is no longer required in most states, and arson occurs by the burning of any real property without consent or with unlawful intent. Arson is prosecuted with attention to degree of severity in the alleged offense. First degree arson generally occurs when persons are harmed or killed in the course of the fire, while second degree arson occurs when significant destruction of property occurs. Arson may also be prosecuted as a misdemeanor, "criminal mischief", or "destruction of property." Burglary also occurs, if the arson involved a "breaking and entering". A criminal may be sentenced to death penalty if arson occurred as a method of homicide, as was the recent case in Texas of Cameron Willingham.

3.England and Scotland

In English law, arson was a common law offence which was recently defined again and codified by the Criminal Damage Act 1971. In Scots Law, the term "fire raising" has always been used instead of "arson", but their meanings are the same.

4.Motives

Arsonists often file fraudulent insurance claims after committing arson. Financial gain is a common motive for arsonists. Some arson is committed to conceal or disguise other crimes. Some may be committed by 'enforcers' of protection rackets as consequences of failing to pay extortionists. Arson in Southeast Asian wilderness may result from political conflicts, from private companies wanting to purchase cheap land, and to generate future work opportunities. Revenge may also be a key factor, as indigenous and migrant farmers use arson as a tool during land conflicts. Victims property is often damaged or destroyed, compromising physical safety and sometimes causing personal injury. Domestic violence sometimes results in arson. Firefighters are occasionally found to have committed arson, with motives including revenge, pyroterrorism or pyromania. Anger and frustration are behind the arsons perpetrated by juvenile vandals. Vandalism through fire often occurs in vacant or abandoned buildings - for instance schools. Cities usually encourage owners to secure vacant buildings. Fire departments aggressively attack fires in abandoned buildings out of concern for the transient or homeless people that may be dwelling inside.

5.Notable historical instances of arson

Political ideology motivates some acts of arson. For example, some members of the Earth Liberation Front are believed to have set fires to structures in order to spread a message of environmental protection. And in virtually every human conflict/war throughout history, acts of arson have been committed or attributed to each side of the conflict, such as in the American Civil War, Kristallnachtpogroms in Nazi Germany in 1938 when a thousand Jewish synagogues were burnt or most recently, Serbian protests of Kosovo's Independence, at the Serbia-Kosovo border on February 19 2008 and at the American Embassy in Belgrade on February 21 2008.

It was rumored that Roman emperor Nero purposefully ordered the Great Fire of Rome, which erupted on the night of July 18 CE64. In reality, the fire started from the shops selling flammable goods at the south-eastern end of the Circus Maximusand reportedly lasted for nine days. Political power motivates others, such as the notorious Reichstag fire of February 1933, when the main parliament building in Germanywas burnt to the ground. Marinus van der Lubbe was executed for the crime. Historians continue to debate whether members of the

Nazi Party were involved, but the fire likely contributed to a Nazi-led coalition winning a majority in the German parliament in March 1933.

6.Wildfire

A wildfire is any uncontrolled, non-structure fire that occurs in the wilderness, wildland, or bush. Synonyms such as wildland fire,forest fire, brush fire, vegetation fire, grass fire, peat fire, bushfire (in Australasia), and hill fire are commonly used. The name wildfire was once a synonym for Greek fire as well as a word for any furious or destructive conflagration. Wildfires are common in various parts of the world, occurring in cycles. They are often considered beneficial to the wilderness, as many plant species are dependent on the effects of fire for growth and reproduction. However, large wildfires often have detrimental atmospheric consequences. Nine out of ten wildfires are reportedly caused by some human interaction.

Prevention, detection, and suppression strategies have varied over the years, but now incorporate techniques that permit and even encourage fires in some regions. However, with extensive urbanization of wilderness, wildfires often involve the destruction of homes and other property located in the wildland-urban interface, a zone of transition between developed areas and undeveloped wilderness.

7.Experimental fire in Canada

Wildfires start when an ignition source meets a combustible material (e.g. wood) subjected to sufficient heat with an adequate supply of oxygen (see Fire triangle). Even before the actual flames arrive, the wildfire front can dry and pre-heat flammable material due to temperatures nearing 800 C (1,470 F). A wildfire front is the portion sustaining continuous flaming combustion, where unburned material meets active flames, or the smoldering transition between unburned and burned material. As the front nears, the fire heats the surrounding air and woody material through convection and thermal radiation. First, wood is dried as water is vaporized at a temperature of 100 C (212 F), then pyrolyzedaround 230 C (450 F) to release flammable gases, then either will smolder around 380 C (720 F) or ignite around 590 C (1,100 F) (see also Flash point).

A high moisture content usually prevents ignition and slows propagation, because higher temperatures are required to evaporate the contained water and heat the material to its flash point. Dense forests usually provide more shade resulting in lower temperatures and greater

humidity. Additionally, less dense material such as grasses and leaves are easier to ignite because they contain less water than denser material such as branches and trunks. Plants continuously lose water to evaporation, but water loss is usually balanced by water absorbed from the soil, humidity, or rain. When this balance is not maintained, plants dry out and are therefore more flammable, often a consequence of a long, hot, dry periods.

8.**Causes**

Causes are numerous and include lightning, arson, volcanic activity, pyroclasticclouds, and underground coal fires. Human activity plays a major role in wildfires, as fire is often considered the least expensive way to clear and prepare land for future use (see Slash-and-burn farming). Forested areas cleared by logging encourages the dominance of flammable grasses, and abandoned logging roads overgrown by vegetation may act as fire corridors. Additionally, annual grassland fires in South Vietnam can be attributed in part to the destruction of forested areas by herbicides, explosives, and mechanical land clearing and burning operations during the Vietnam War.

9.**Extremes**

Fires in forested areas can move at speeds of 10.8 kilometres per hour (7 mph), while grass fires have been recorded at up to 22 kilometres per hour (14 mph). Wildfires can advance tangential to the main front to form a flankingfront or burn opposite the direction of the main front by backing. Wildfires may also spread byjumping or spotting, as winds and vertical convection columns carry hot wood embers (firebrands) and other burning materials through the air over roads, rivers, and other natural barriers or firebreaks. Torching and crown fires are prone to spotting, and dry ground fuels that surround a wildfire are especially vulnerable to ignition from firebrands. In Australian bushfires, spot fires have been documented "up to 10 kilometres(6 mi) ahead of the fire front." Air rises as it is heated, and large wildfires create powerful updrafts that will draw in new air from surrounding areas (see Thermal column, Stack effect). Great vertical differences in temperature and humidity encourage pyrocumulus clouds and intense winds, which are often 10 times faster than ambient wind (more than 50 miles per hour (80 km/h)). Extreme fire behavior includes wide rates of spread, prolific crowning and/or spotting, the presence of fire whirls, and a strong convection column.

10. **Ecology**

Wildfires are common in climates that are sufficiently moist to allow the growth of trees but feature extended dry, hot periods. Such places include the vegetated areas of Australia and south east Asia, the veld in the interior and the fynbosin the Western Cape of South Africa, and the forested areas of the United States and Canada. Fires can be particularly intense during days of strong winds and periods of drought. Fire prevalence is also high during the summer and autumn months, when fallen branches, leaves, grasses, and scrub dry out and become more flammable. Global warming may increase the intensity and frequency of droughts in many areas, creating more intense and frequent wildfires.

Wildfires are considered a natural part of the ecosystem of numerous wildlands, where some plants have evolved to survive fires by a variety of strategies, such as fire-resistant seeds and reserve shoots that sprout after a fire (see Pioneer species). Smoke, charred wood, and heat are common fire cues that stimulate the germination of seeds. Exposure to smoke from burning plants promotes germination in other types of plants by inducing the production of the orange butenolide. Grasslands in Western Sabah, Malaysian pine forests, and Indonesian Casuarinaforests are believed to have resulted from previous periods of fire. Plants of the genus Eucalyptus contain flammable oils that can encourage fire, and hard sclerophyllleaves to resist heat and drought, ensuring their dominance over less fire-tolerant species.

However, many ecosystems are suffering from too much fire, such as the chaparral in southern California and lower elevation deserts in the American Southwest. The increased fire frequency in these areas has caused the elimination of native plant communities and have replaced them with non-native weeds. Invading species such as Lygodium microphyllumand Bromus tectorummay create a positive feedback loop, increasing fire frequency even more. Wildfires generate ash, destroy available organic nutrients, and cause an increase in water runoff, eroding away other nutrients and creating flash flood conditions. Also, wildfires can have an effect on climate change, increasing the amount of carbon released into the atmosphere and inhibiting vegetation growth, which affects overall carbon uptake by plants.

11. **Atmospheric effects**

Most of the Earth's weather and air pollution reside in the troposphere, the part of the atmosphere that extends from the surface of the planet to a height of between 8 and 13 kilometers. A severe thunderstorm or pyrocumulonimbusin the area of a large wildfire can have its vertical lift enhanced to boost smoke, soot and other particulate matter as high as the

lower stratosphere. Previously, it was thought that most particles in the stratosphere came from volcanoes, but smoke and other wildfire emissions have been detected from the lower stratosphere. Pyrocumulus clouds can reach 20,000 feet (6,100 m) over wildfires. With an increase in fire byproducts in the stratosphere, ozone concentration was three times more likely to exceed health standards. Satellite observation of smoke plumes from wildfires revealed that the plumes could be traced intact for distances exceeding 1,000 miles (1,600 km). Computer-aided models (e.g. CALPUFF) may help predict the size and direction of wildfire-generated smoke plumes (see Atmospheric dispersion modeling).
Wildfires can affect climate and weather and have major impacts on regional and global pollution. Wildfire emissions contain greenhouse gases and a number of criteria pollutants which can have a substantial impact on human health and welfare. Forest fires in Indonesiain 1997 were estimated to have released between 0.81 and 2.57 gigatonnes of CO_2 into the atmosphere, which is between 13-40% of the annual carbon dioxide emissions from burning fossil fuels. Atmospheric models suggest that these concentrations of sooty particles could increase absorption of incoming solar radiation during winter months by as much as 15%.

12. Prevention

Wildfire prevention "involves all measures that impede the outbreak of fire or reduce its severity and spread." Effective prevention techniques allow supervising agencies to manage air quality, maintain ecological balances, protect resources, as well as limiting the effects of future uncontrolled fires. Many wilderness areas are now considered fire-dependent, and previous policies of complete suppression are believed to have upset natural cycles and increased fuel loads and the amount of fire intolerant vegetation. Current policies often permit fires to burn to maintain their ecological role, so long as the risks of escape onto high-value areas are mitigated. However, prevention policies must consider the role that humans play in wildfires, since, for example, only 5% of forest fires in Europe are not related to human involvement. Sources of human-caused fire may include arson, accidental ignition, or the uncontrolled use of fire in land-clearing and agriculture (for example, slash-and-burn farming in Southeast Asia).

In the mid-1800s, explorers from the HMS Beagle observed Australian Aborigines using fire for ground clearing, hunting, and regeneration of plant food (see Fire-stick farming) Such careful use of fire has been employed for centuries in the KakaduNational Park to encourage biodiversity. In 1937, US President Franklin D. Roosevelt initiated a nationwide fire

prevention campaign, highlighting the role of human carelessness in forest fires. Later posters of the program featured Uncle Sam, leaders of the Axis powers of World War II, characters from the Disney movie Bambi, and lastly Smokey Bear.

While wildfires are a combination of factors such as topology, fuels, and weather, only fuels may be altered to affect future fire risk and behavior. Current wildfire prevention programs may employ techniques such as wildland fire use and prescribed burns (controlled burns). Wildland fire use refers to any fire of natural causes that is monitored but allowed to burn. Controlled burns are fires ignited by government agencies under less dangerous weather conditions. Vegetation may be burned periodically to maintain high species diversity, and frequent burning of surface fuels limits fuel accumulation, thereby reducing the risk of crown fires. Using strategic cuts of trees, fuels may also be removed by hand crews in order to clean and clear the forest, prevent fuel build-up, and create access into forested areas. Chain saws and large equipment can be used to thin out ladders fuels and shred trees and vegetation to a mulch. Multiple fuel treatments are often needed to influence future fire risks, and wildfire models may be used to predict and compare the benefits of different fuel treatments on future wildfire spread. However, controlled burns are reportedly "the most effective treatment for reducing a fires rate of spread, fireline intensity, flame length, and heat per unit of area." Additionally, while fuel treatments are typically limited to smaller areas, effective fuel management requires the administration of fuels across large landscapes in order to reduce future fire size and severity.

Building codes in fire-prone areas typically require that structures be built of flame-resistant materials and a defensible space be maintained by clearing flammable materials within a prescribed distance from the edifice. Communities in the Phillipinesalso maintain fire lines 5-10 metres (16-32 feet) wide between the forest and their village, and patrol these lines during summer months or seasons of dry weather.

13. **Detection**

Fast and effective detection is a key factor in wildfire fighting. Early detection efforts were focused on early response, accurate day and nighttime use, the ability to prioritize fire danger, and fire size and location in relation to topography. Fire lookout towers were used in the early 1900s, and fires were reported using telephones, carrier pigeons, and heliographs. Aerial and land photography using instant cameras were used in the 1950s until infrared scanning was developed for fire detection in the 1960s. However, information analysis and delivery was

often delayed by limitations in communication technology. Early satellite-derived fire analyses were hand-drawn on maps at a remote site and sent via overnight mail to the fire manager. During the Yellowstone fires of 1988, a data station was established in West Yellowstone, permitting fire information delivery in approximately four hours.

Currently, public hotlines, fire lookouts in towers, and ground and aerial patrols can be used as a means of early detection of forest fires. However, accurate human observation may be limited by operator fatigue (see Asthenopia), time of day, time of year, and geographic location. Electronic systems have gained popularity in recent years as a possible resolution to human operator error. These systems may be semi- or fully-automated and employ systems based on the risk area and degree of human presence, as suggested by GIS data analyses. An integrated approach of multiple systems can be used to merge satellite data, aerial imagery, and personnel position via GPS into a collective whole for near-realtime use by wireless Incident Command Centers.

A small, high risk area (thick vegetation, strong human presence or close to critical urban area) can be monitored using a local sensor network. Detection systems may include wireless sensor networks that act as automated weather systems: detecting temperature, humidity, and smoke. These may be battery-powered, solar-powered, or tree-rechargeable: able to recharge their battery systems using the small electrical currents in plant material. Larger, medium-risk areas could be monitored by scanning towers that incorporate fixed cameras and sensors to detect smoke or additional factors such as the "infrared signature of carbon dioxide produced by fires." Brightness and color change detection as well as night vision capabilities may be incorporated also into sensor arrays.

Satellite and aerial monitoring can provide a wider view and may be sufficient to monitor very large, low risk areas. These more sophisticated systems employ GPS and aircraft-mounted infrared or high-resolution visible cameras to identify and target wildfires. Satellite-mounted sensors such as Envisat'sAATSR and ERS-2's ATSR can measure infrared radiation emitted by fires, identifying hot spots greater than 39 C (102 F). The NOAA's Hazard Mapping System combines remote-sensing data from satellite sources such as GOES,

MODIS, and AVHRR for detection of fire and smoke plume locations. However, satellite detection is prone to offset errors, anywhere from 2-3 km (1-2 mi) for MODIS and AVHRR data and up to 12 km (7.5 mi) for GOES data. Satellites in geostationary orbits may become disabled, and satellites in polar orbits are often limited by their short window of observation time. Cloud cover and image resolution and may also limit the effectiveness of satellite imagery.

14. **Modeling**

Wildfire modeling involves the statistical analysis of past fire events to predict spotting risks and front behavior. Various wildfire propagation models have been proposed in the past, including simple ellipses, egg-shaped, and fan-shaped. Early attempts to determine wildfire behavior assumed terrain and vegetation uniformity. However, the exact behavior of a wildfire's front is dependent on a variety of factors, including windspeed and slope steepness. Modern growth models utilize a combination of past ellipsoidal descriptions and Huygens' Principle to simulate fire growth as a continuously expanding polygon. However, large fires that exceed suppression capabilities are often regarded as statistical outliers in these analyses (see Extreme value theory), even though catastrophic wildfires greatly influence fire policies.

15. **Suppression**

Wildfire suppression many include a variety of tools and technologies, from throwing sand and beating fires with sticks and palm fronds in rural Thailand, to full-scale aerial assaults by planes and helicopters using drops of water and fire retardants. Complete fire suppression is no longer an expectation, but the majority of wildfires are often extinguished before they grow out of control. While more than 99% of the 10,000 new wildfires each year are contained, escaped wildfires can cause extensive damage. Wildfires in the United Statesare responsible for "about 95% of the total acres burned and close to 85% of all suppression costs," as suppression efforts and damage caused can exceed billions of US dollars annually.Yearly fires in Canadaconsume an average of 6,200,000 acres (25,000 km^2) and in the USan average of 7,320,000 acres (29,600 km^2).

Fuel buildup can result in costly, devastating fires as more new houses and ranches are built adjacent to wilderness areas. Continued growth in fire-prone areas and rebuilding structures destroyed by fires has been met with criticism. However, the population growth along the wildland-urban interface discourages the use of current fuel management techniques. Smoke is an irritant and attempts to thin out the fuel load is met with opposition due to desirability of forested areas, in addition to other wilderness goals such as endangered species protection and habitat preservation. The ecological benefits of fire is often overridden by the economic benefits of protecting structures and lives. Additionally, government policies that cover the wilderness usually differs from local and state policies that govern urban lands

Topic Objective:

- Fire fighting
- Fire prevention
- Model building
- Hazardous Materials Appliances
- Logistical Support Appliances
- Passive visual warnings
- Active visual warnings
- Audible warnings
- Additional equipment
- Campbell Shopping Complex fire inferno
- Sawtooth Complex fire

Definition/Overview:

Fire fighting: Fire fighting services are provided in most developed areas to extinguish or contain uncontrolled fires. Trained firefighters use fire trucks, water supply resources such as water mains and fire hydrants or they might use A and B class foam depending on what is feeding the fire. An array of other equipment to combat the spread of fires.

Fire prevention: Fire prevention is intended to reduce sources of ignition, and is partially focused on programs to educate people from starting fires. Buildings, especially schools and

tall buildings, often conduct fire drills to inform and prepare citizens on how to react to a building fire. Purposely starting destructive fires constitutes arson and is a criminal offense in most jurisdictions.

Model building: Model building codes require passive fire protection and active fire protection systems to minimize damage resulting from a fire. The most common form of active fire protection is fire sprinklers. To maximize passive fire protection of buildings, building materials and furnishings in most developed countries are tested for fire-resistance, combustibility and flammability. Upholstery, carpeting and plastics used in vehicles and vessels are also tested.

Key Points:

1. Hazardous Materials Appliances

Some fire departments keep special appliances for dealing with hazardous materials, or "HazMat". These are of several types, from those used to clean spilled oil on streets and highways, to full decontamination units, designed to clean victims and rescuers of contaminants after an incident.

2. Logistical Support Appliances

Many fire departments operate a number of vehicles in specialised logistical functions. These can be stand alone vehicles, or may be modular, such as with the use of a 'hookloader' system

Sometimes hookloadersare used for seldom-used equipment. A hookloader can load a container very rapidly and act as a special unit with lower investment costs. For example, the Helsinki Rescue Department in Finland has several hookloader trucks and more than 40 containers including a water container, a hose container, an oil destruction container. Containers may also carry a command post, material for catastrophes, hoses and pumps for forest fires, even field hospitals, or for example, high-power pumps.

3. Design and construction

Many fire appliances around the world are based on standard truck or lorry models, which are upgraded to the specifications required by the purchasing department. In the United States, a

majority of fire trucks are specially designed from the chassis to the cab and body. This has led to the use of the term custom fire truck, as opposed to a commercial chassis and cab.

Modifications a fire appliance might undergo include adjustments for higher durability, removal of any speed limiter, and adjustments for long periods of idling at a higher temperature. This may be accomplished by heavy duty suspensions, brakes, tires, alternator, transmission and cooling systems. It is also usual to upgrade the capacity of the electrics of the vehicle, in order to accommodate the use of additional electrical and electronic equipment. Fire appliances have audible and visual warnings, to protect themselves from traffic, and make themselves seen to other units at an incident. In many countries, use of the audible and visual warnings affords the driver a degree of exemption from road traffic laws (such as the right to exceed speed limits, treat red stop lights as give way etc.) and may also infer a duty on other motorists to move out of the direction of passage of the fire vehicle (or face possible prosecution).

4. Visual warnings

Visual warnings on a fire appliance can be of two types - either passive or active.

5.Passive visual warnings

The passive visual warnings involve the use of high contrast patterns. Older vehicles (and those in developing countries) are more likely to have their patterns painted on, whereas modern appliances often carry retro-reflective designs which reflect light from car headlights or torches. Patterns include 'checker board' (alternate coloured squares, sometimes called 'battenburgmarkings', named after a type of cake), chevrons (arrowheads - often pointed towards the front of the vehicle if on the side, or pointing vertically upwards if on the rear) or stripes (along the side - these were the first type or retro-reflective devices introduced, as the original retro-reflective material came only in tape form). In some countries, in addition to retro-reflective markings, vehicles are now painted a bright yellow or orange, although in many other countries, red remains the colour for fire engines.

Another passive marking is the word FIRE, RESCUE or local language variant spelled out in reverse on the front of the vehicle. This enables drivers of other vehicles to more easily identify an approaching fire service vehicle in their rear view mirrors. The appliance may

also display a telephone number which may be used to summon assistance, along with the name of the operating department or station identifier.

6. Active visual warnings

The active visual warnings are usually in the form of flashing coloured lights (also known as 'beacons' or 'lightbars'). These flash in order to attract the attention of other road users as the fire appliance approaches, or to provide warning to motorists approaching a stopped appliance in a dangerous position on the road. Common coloursfor fire warning beacons are blue and red. The beacons can be made to flash, the original method was to place a spinning mirror which moves around a light bulb, called a 'rotating beacon'. More modern methods include the use of strobe lights, which are usually brighter, and can be programmed to produce specific patterns (such as a left -> right pattern when parked on the left hand side of the road, indicating to other road users that they should move out away from the vehicle). There is also the more widespread use of LED flashing lights as they are low profile and low energy.

7.Audible warnings

In addition to visual warnings, most appliances are also fitted with audible warnings, sometimes known as sirens, which can alert people and vehicles to the presence of an emergency vehicle before they can be seen. The first audible warnings were mechanical bells, mounted to either the front or roof of the truck. Most vehicles are now fitted with electronic sirens, which can produce a range of different noises. Fire service driving training often includes the use of different noises depending on traffic conditions and manoeuvre being performed. For instance, on a clear road, approaching a junction, the 'wail' setting may be used, which gives a long up and down variation, with an unbroken tone, whereas, in heavy slow traffic, a 'yelp' setting may be preferred, which is like a wail, but sped up. The speakers for modern sirens can be located in several places on the vehicle, including being integral to the lightbar, or hidden in the grille. Some vehicles may also be fitted with airhorn audible warnings. A number of North American fire departments have returned to the 'acoustic' or 'air' traditional siren as its overtones help the public 'locate' and avoid the firetruck--the newer electronic signals disperse almost pure tones which are hard to locate, especially in city 'canyons' of buildings.

A development is the use of the RDS system of car radios, whereby the vehicle can be fitted with a short range FM transmitter, set to RDS code 31, which interrupts the radio of all cars within range, in the manner of a traffic broadcast, but in such a way that the user of the receiving radio is unable to opt out of the message (as with traffic broadcasts). This feature is built in to all RDS radios for use in national emergency broadcast systems, but short range units on emergency vehicles can prove an effective means of alerting traffic to their presence, although is not able to alert pedestrians and non-RDS radio users.

8. Additional equipment

Firefighters may also have a range of additional equipment available to them, which may include:

- Two Way Radio - One of the most important pieces of equipment. Many services have moved from traditional UHF/VHF sets, which can be monitored externally, to more secure systems, such as those working on a GSM system, such as TETRA.
- Mobile Data Terminal - Many appliances are fitted with Mobile Data Terminals (or MDTs), which are connected wirelessly to a central computer, and enable firefighters to call up details such as incident logs, maps of locations or exclusion zones.
- Evidence gathering CCTV - Some fire vehicles can be fitted with video cameras used to record activity. They may also be fitted with sound recording facilities. This is used for the protection of the crew (and evidence of any assaults or intimidation of the firefighters) or can be used as evidence relating to the incident itself.
- Ramming pads - These rubberised pads are fitted to the chassis of the appliance, to allow the vehicle to be used as a battering ram, or to push other vehicles off the road in an emergency.

9. CampbellShopping Complex fire inferno

The Campbell Shopping Complex fire was a major disaster in Malaysiawhich took place on 8 April 1976 at Jalan Campbell (now Jalan Dang Wangi), Kuala Lumpur. The entire shopping complex including its 20 storey office tower block were completely destroyed in a fire. It was Malaysia's first towering inferno and the worst fire disaster involving a highrise building to date. The fire, which started at 10.30 pm, lasted for nearly 30 hours, claiming the life of one victim, Yap Leong Hoem, 59, as well as the total losses of RM50 million. The cause of the fire was an electrical short circuit.

The building was burnt for nearly 30 hours and fortunately, it did not collapse entirely as one section of the podium had collapsed due to the intense heat. The building was only three years old at the time of the blaze, having being opened in 1973 which was at that time Kuala Lumpur's first highrise shopping complex. It was kept under repair and reconstructed for a few years after the blaze before it was reopened to the public around 1979.

10. Sawtooth Complex fire

The SawtoothComplex fire was a group of wildfires in San Bernardino County in the U.S. state of California in the summer of 2006. The Complex was made up of the Sawtooth, Waters, and Ridge fires, and burnt in chaparral two miles (3.2 km) east of Yucca Valley.

The SawtoothComplex fire was started by lightning on July 9, 2006 at 8:30 am PDT. The fire burned 61,700 acres (250 km) and destroyed 50 homes, 8 mobile homes, 13 garages, 171 outbuildings, 191 cars and pick up trucks, 3 R.V.s, 27 trailers, 2 railcars, 9 tractors. 12 residences were damaged. There were 17 minor injuries and 1 civilian fatality.

Residents of Pioneertown, Skyline Ranch, Pipes Canyon, Gamma Gulch, northern MorongoValley, Burns Canyonand Rimrock were placed under mandatory evacuations. Pioneertown is the site of several historic structures dating back to 1940s Hollywood film production. While some buildings in Pioneertown were destroyed, the historic structures were spared. At 5:00 pm PDT on July 14, the Sawtooth Complex fire merged with the Millard Complex fire. The fire was 100% contained on July 18

Section 5 of this course you will cover these topics:

- Fire Prevention Research
- Proving Fire Prevention Works

Topic Objective:

- Fire fighting
- Fire prevention
- Model building

- Hazardous Materials Appliances
- Logistical Support Appliances
- Passive visual warnings
- Active visual warnings
- Audible warnings
- Additional equipment
- Campbell Shopping Complex fire inferno
- Sawtooth Complex fire

Definition/Overview:

Fire fighting: Fire fighting services are provided in most developed areas to extinguish or contain uncontrolled fires. Trained firefighters use fire trucks, water supply resources such as water mains and fire hydrants or they might use A and B class foam depending on what is feeding the fire. An array of other equipment to combat the spread of fires.

Fire prevention: Fire prevention is intended to reduce sources of ignition, and is partially focused on programs to educate people from starting fires. Buildings, especially schools and tall buildings, often conduct fire drills to inform and prepare citizens on how to react to a building fire. Purposely starting destructive fires constitutes arson and is a criminal offense in most jurisdictions.

Model building: Model building codes require passive fire protection and active fire protection systems to minimize damage resulting from a fire. The most common form of active fire protection is fire sprinklers. To maximize passive fire protection of buildings, building materials and furnishings in most developed countries are tested for fire-resistance, combustibility and flammability. Upholstery, carpeting and plastics used in vehicles and vessels are also tested.

Key Points:

1. Hazardous Materials Appliances

Some fire departments keep special appliances for dealing with hazardous materials, or "HazMat". These are of several types, from those used to clean spilled oil on streets and

highways, to full decontamination units, designed to clean victims and rescuers of contaminants after an incident.

2. Logistical Support Appliances

Many fire departments operate a number of vehicles in specialised logistical functions. These can be stand alone vehicles, or may be modular, such as with the use of a 'hookloader' system

Sometimes hookloadersare used for seldom-used equipment. A hookloader can load a container very rapidly and act as a special unit with lower investment costs. For example, the Helsinki Rescue Department in Finland has several hookloader trucks and more than 40 containers including a water container, a hose container, an oil destruction container. Containers may also carry a command post, material for catastrophes, hoses and pumps for forest fires, even field hospitals, or for example, high-power pumps.

3. Design and construction

Many fire appliances around the world are based on standard truck or lorry models, which are upgraded to the specifications required by the purchasing department. In the United States, a majority of fire trucks are specially designed from the chassis to the cab and body. This has led to the use of the term custom fire truck, as opposed to a commercial chassis and cab.

Modifications a fire appliance might undergo include adjustments for higher durability, removal of any speed limiter, and adjustments for long periods of idling at a higher temperature. This may be accomplished by heavy duty suspensions, brakes, tires, alternator, transmission and cooling systems. It is also usual to upgrade the capacity of the electrics of the vehicle, in order to accommodate the use of additional electrical and electronic equipment. Fire appliances have audible and visual warnings, to protect themselves from traffic, and make themselves seen to other units at an incident. In many countries, use of the audible and visual warnings affords the driver a degree of exemption from road traffic laws (such as the right to exceed speed limits, treat red stop lights as give way etc.) and may also infer a duty on other motorists to move out of the direction of passage of the fire vehicle (or face possible prosecution).

4. Visual warnings

Visual warnings on a fire appliance can be of two types - either passive or active.

5.Passive visual warnings

The passive visual warnings involve the use of high contrast patterns. Older vehicles (and those in developing countries) are more likely to have their patterns painted on, whereas modern appliances often carry retro-reflective designs which reflect light from car headlights or torches. Patterns include 'checker board' (alternate coloured squares, sometimes called 'battenburgmarkings', named after a type of cake), chevrons (arrowheads - often pointed towards the front of the vehicle if on the side, or pointing vertically upwards if on the rear) or stripes (along the side - these were the first type or retro-reflective devices introduced, as the original retro-reflective material came only in tape form). In some countries, in addition to retro-reflective markings, vehicles are now painted a bright yellow or orange, although in many other countries, red remains the colour for fire engines.

Another passive marking is the word FIRE, RESCUE or local language variant spelled out in reverse on the front of the vehicle. This enables drivers of other vehicles to more easily identify an approaching fire service vehicle in their rear view mirrors. The appliance may also display a telephone number which may be used to summon assistance, along with the name of the operating department or station identifier.

6. Active visual warnings

The active visual warnings are usually in the form of flashing coloured lights (also known as 'beacons' or 'lightbars'). These flash in order to attract the attention of other road users as the fire appliance approaches, or to provide warning to motorists approaching a stopped appliance in a dangerous position on the road. Common coloursfor fire warning beacons are blue and red. The beacons can be made to flash, the original method was to place a spinning mirror which moves around a light bulb, called a 'rotating beacon'. More modern methods include the use of strobe lights, which are usually brighter, and can be programmed to produce specific patterns (such as a left -> right pattern when parked on the left hand side of the road, indicating to other road users that they should move out away from the vehicle).

There is also the more widespread use of LED flashing lights as they are low profile and low energy.

7.Audible warnings

In addition to visual warnings, most appliances are also fitted with audible warnings, sometimes known as sirens, which can alert people and vehicles to the presence of an emergency vehicle before they can be seen. The first audible warnings were mechanical bells, mounted to either the front or roof of the truck. Most vehicles are now fitted with electronic sirens, which can produce a range of different noises. Fire service driving training often includes the use of different noises depending on traffic conditions and manoeuvre being performed. For instance, on a clear road, approaching a junction, the 'wail' setting may be used, which gives a long up and down variation, with an unbroken tone, whereas, in heavy slow traffic, a 'yelp' setting may be preferred, which is like a wail, but sped up. The speakers for modern sirens can be located in several places on the vehicle, including being integral to the lightbar, or hidden in the grille. Some vehicles may also be fitted with airhorn audible warnings. A number of North American fire departments have returned to the 'acoustic' or 'air' traditional siren as its overtones help the public 'locate' and avoid the firetruck--the newer electronic signals disperse almost pure tones which are hard to locate, especially in city 'canyons' of buildings.

A development is the use of the RDS system of car radios, whereby the vehicle can be fitted with a short range FM transmitter, set to RDS code 31, which interrupts the radio of all cars within range, in the manner of a traffic broadcast, but in such a way that the user of the receiving radio is unable to opt out of the message (as with traffic broadcasts). This feature is built in to all RDS radios for use in national emergency broadcast systems, but short range units on emergency vehicles can prove an effective means of alerting traffic to their presence, although is not able to alert pedestrians and non-RDS radio users.

8. Additional equipment

Firefighters may also have a range of additional equipment available to them, which may include:

8.1.Two Way Radio

One of the most important pieces of equipment. Many services have moved from traditional UHF/VHF sets, which can be monitored externally, to more secure systems, such as those working on a GSM system, such as TETRA

8.2. Mobile Data Terminal

Many appliances are fitted with Mobile Data Terminals (or MDTs), which are connected wirelessly to a central computer, and enable firefighters to call up details such as incident logs, maps of locations or exclusion zones.

8.3.Evidence gathering CCTV

Some fire vehicles can be fitted with video cameras used to record activity. They may also be fitted with sound recording facilities. This is used for the protection of the crew (and evidence of any assaults or intimidation of the firefighters) or can be used as evidence relating to the incident itself.

8.4.Ramming pads

These rubberised pads are fitted to the chassis of the appliance, to allow the vehicle to be used as a battering ram, or to push other vehicles off the road in an emergency.

9. CampbellShopping Complex fire inferno

The Campbell Shopping Complex fire was a major disaster in Malaysiawhich took place on 8 April 1976 at Jalan Campbell (now Jalan Dang Wangi), Kuala Lumpur. The entire shopping complex including its 20 storey office tower block were completely destroyed in a fire. It was Malaysia's first towering inferno and the worst fire disaster involving a highrise building to date. The fire, which started at 10.30 pm, lasted for nearly 30 hours, claiming the life of one victim, Yap Leong Hoem, 59, as well as the total losses of RM50 million. The cause of the fire was an electrical short circuit.

The building was burnt for nearly 30 hours and fortunately, it did not collapse entirely as one section of the podium had collapsed due to the intense heat. The building was only three years old at the time of the blaze, having being opened in 1973 which was at that time Kuala

Lumpur's first highrise shopping complex. It was kept under repair and reconstructed for a few years after the blaze before it was reopened to the public around 1979.

10. Sawtooth Complex fire

The SawtoothComplex fire was a group of wildfires in San Bernardino County in the U.S. state of California in the summer of 2006. The Complex was made up of the Sawtooth, Waters, and Ridge fires, and burnt in chaparral two miles (3.2 km) east of Yucca Valley.

The SawtoothComplex fire was started by lightning on July 9, 2006 at 8:30 am PDT. The fire burned 61,700 acres (250 km) and destroyed 50 homes, 8 mobile homes, 13 garages, 171 outbuildings, 191 cars and pick up trucks, 3 R.V.s, 27 trailers, 2 railcars, 9 tractors. 12 residences were damaged. There were 17 minor injuries and 1 civilian fatality.

Residents of Pioneertown, Skyline Ranch, Pipes Canyon, Gamma Gulch, northern MorongoValley, Burns Canyonand Rimrock were placed under mandatory evacuations. Pioneertown is the site of several historic structures dating back to 1940s Hollywood film production. While some buildings in Pioneertown were destroyed, the historic structures were spared. At 5:00 pm PDT on July 14, the Sawtooth Complex fire merged with the Millard Complex fire. The fire was 100% contained on July 18.

11. Applications In organizations

Planning is also a management function, concerned with defining goals for future organizational performance and deciding on the tasks and resources to be used in order to attain those goals. To meet the goals, managers may develop plans such as a business plan or a marketing plan. Planning always has a purpose. The purpose may be achievement of certain goals or targets. The planning helps to achieve these goals or target by using the available time and resources. To minimize the timing and resources also require proper planning.

12. In public policy

Planning refers to the practice and the profession associated with the idea of planning an idea yourself, (land use planning, urban planning or spatial planning). In many countries, the operation of a town and country planning system is often referred to as 'planning' and the professionals which operate the system are known as 'planners'..... Planning: Planning is a

process for accomplishing purpose. It is blue print of business growth and a road map of development. It helps in deciding objectives both in quantitative and qualitative terms. It is setting of goals on the basis of objectives and keeping in view the resources.

It is a conscious as well as sub-conscious activity. It is an anticipatory decision making process that helps in coping with complexities. It is deciding future course of action from amongst alternatives. It is a process that involves making and evaluating each set of interrelated decisions. It is selection of missions, objectives and translation of knowledge into action.

A planned performance brings better results compared to unplanned one. A Managers job is planning, monitoring and controlling. Planning and goal setting are important traits of an organization. It is done at all levels of the organization. Planning includes the plan, the thought process, action, and implementation. Planning gives more power over the future. Planning is deciding in advance what to do, how to do it, when to do it, and who should do it. It bridges the gap from where the organization is to where it wants to be. The planning function involves establishing goals and arranging them in logical order.

13. Life

An entity with the above properties is considered to be a living organism, hence, a 'life form'. However, not every definition of life considers all of these properties to be essential. For example, the capacity for evolution is sometimes taken as the only essential property of life; this definition notably includes viruses, which do not qualify under narrower definitions as they are acellularand do not metabolize.

A diverse array of living organisms can be found in the biosphere on Earth. Properties common to these organismsplants, animals, fungi, protists, archaea and bacteriaare a carbon- and water-based cellular form with complex organization and heritable genetic information. They undergo metabolism, possess a capacity to grow, respond to stimuli, reproduce and, through natural selection, adapt to their environment in successive generations. So far, there is no evidence of extraterrestrial life.

14. Definitions

There is no universal definition of life. To define life in unequivocal terms is still a challenge for scientists, as the definition must be sufficiently broad that would encompass all life with which we are familiar. It should be sufficiently general that, with it, scientists would not miss life that may be fundamentally different from earthly life. In addition, defining life requires measurable terms, and when derived from analysis of known organisms, life is usually defined at the cellular level.

15. Conventional definition

The consensus is that life is a characteristic of organisms that exhibit all or most of the following phenomena:

15.1. Homeostasis

Regulation of the internal environment to maintain a constant state; for example, electrolyte concentration or sweating to reduce temperature.

15.2. Organization

Being structurally composed of one or more cells, which are the basic units of life.

15.3. Metabolism

Consumption of energy by converting chemicals and energy into cellular components (anabolism) and decomposing organic matter (catabolism). Living things require energy to maintain internal organization (homeostasis) and to produce the other phenomena associated with life.

15.4. Growth

Maintenance of a higher rate of synthesis than catabolism. A growing organism increases in size in all of its parts, rather than simply accumulating matter. The particular species begins to multiply and expand as the evolution continues to flourish.

15.5. Adaptation

The ability to change over a period of time in response to the environment. This ability is fundamental to the process of evolution and is determined by the organism's heredity as well as the composition of metabolized substances, and external factors present.

15.6. Response to stimuli

A response can take many forms, from the contraction of a unicellular organism to external chemicals, to complex reactions involving all the senses of higher animals. A response is often expressed by motion, for example, the leaves of a plant turning toward the sun (phototropism) and chemotaxis.

15.7. Reproduction

The ability to produce new organisms. Reproduction can be the division of one cell to form two new cells. Usually the term is applied to the production of a new individual (either asexually, from a single parent organism, or sexually, from at least two differing parent organisms), although strictly speaking it also describes the production of new cells in the process of growth.

Also, individual members of a species may not meet all the criteria, but are still considered alive, such as members of a species who are rendered unable to reproduce or unable to respond to stimuli.

Viruses and aberrant prion proteins are most often considered replicators rather than forms of life, a distinction warranted because they cannot reproduce without very specialized substrates, such as host cells or proteins, respectively. Also, the Rickettsiaand Chlamydia are examples of bacteria that cannot independently fulfill many vital biochemical processes, and depend on entry, growth, and replication within the cytoplasm of eukaryotic host cells. However, most forms of life rely on foods produced by other species, or at least the specific chemistry of Earth's environment.

The systemic definition of life is that living things are self-organizing and autopoietic(self-producing). Variations of this definition include Stuart Kauffman's definition of life as an

autonomous agent or a multi-agent system capable of reproducing itself or themselves, and of completing at least one thermodynamic work cycle.

Proposed definitions of life, to reflect the minimum phenomena required:

Living things are systems that to respond to changes in their environment, and inside themselves, in such a way as to promote their own continuation. A network of inferior negative feedbacks (regulatory mechanisms) subordinated to a superior positive feedback (potential of expansion, reproduction). A characteristic of self-organizing, self-recycling systems consisting of populations of replicatorsthat are capable of mutation, around most of which homeostatic, metabolizing organisms evolve. Type of organization of matter producing various interacting forms of variable complexity, whose main property is to replicate almost perfectly by using matter and energy available in their environment to which they may adapt. In this definition "almost perfectly" relates to mutations happening during replication of organisms that may have adaptive benefits. Life is a potentially self-perpetuating open system of linked organic reactions, catalyzed simultaneously and almost isothermally by complex chemicals (enzymes) that are themselves produced by the open system.[citation needed]

16. Origin of life

Although it has not been pinpointed exactly, evidence suggests that life on Earth has existed for about 3.7 billion years. All known life forms share fundamental molecular mechanisms, and based on these observations, theories on the origin of life attempt to find a mechanism explaining the formation of a primordial single cell organism from which all life originates. There are many different hypotheses regarding the path that might have been taken from simple organic molecules via pre-cellular life to protocells and metabolism. Many models fall into the "genes-first" category or the "metabolism-first" category, but a recent trend is the emergence of hybrid models that do not fit into either of these categories. There is no scientific consensus as to how life originated and all proposed theories are highly speculative.

17. Current Life safety code

The Life Safety Code is unique among most codes in that it applies to existing structures as well as new structures. When a Code revision is adopted into local law, existing structures have a grace period before they must comply, but all structures must comply with code.

All or part of a code may be adopted as regulations in a jurisdiction and enforced by an inspector, zoning board, fire marshal, or other officials. In particular, the Life Safety Code deals with hazards in buildings, public conveyances and occupations, and are coordinated with other codes and standards such as electrical, fuel-gas, mechanical, plumbing, energy, and residential. Regardless of official adoption as regulations, life safety code provides a valuable source for determination of liability in accidents, and many codes and related standards are sponsored by insurance companies.m Although life safety codes deal mainly with hazards in buildings, they also cover other emergencies that are similar to fire and are applied to vehicles, vessels and other transports since these objects are treated as buildings for life safety purposes.

The Life Safety Code is coordinated with other building codes and standards such as electrical (National Electric Code NFPA70), fuel-gas, mechanical, plumbing, energy, and residential. Normally, the Life Safety Code is used by architects and designers of vehicles and vessels. Since the Life Safety Code is a valuable source for determining liability in accidents, it is also used by insurance companies to evaluate risks and set rates. In the United States, the words Life Safety Code are a registered trademark of NFPA. All or part of the NFPA'sLife Safety Code are adopted as local regulations throughout the country. The compliance with the Code is enforced by inspectors from local zoning boards, fire departments, or other bodies having jurisdiction

Topic Objective:

- Firefighter
- Overview
- Fog nozzle
- Deluge Gun
- Roles
- Variations
- Pattern
- Goals of firefighting
- Prevention
- Self-preservation
- Occupational health and safety
- Rescue operations

- Communication and command structure
- Structure fires

Definition/Overview:

Firefighter: Firefighters are rescuers extensively trained primarily to put out hazardous fires that threaten civilian populations and property to rescue people from car accidents, collapsed and burning buildings and other such situations. The increasing complexity of modern industrialized life with an increase in the scale of hazards has stimulated both advances in firefighting technology and a broadening of the firefighter-rescuer's remit. They sometimes provide emergency medical services. The fire service, or fire and rescue service also known in some countries as the fire brigade or fire department, are some of the emergency services. Firefighting and firefighters have become ubiquitous around the world, from urban areas to wildland areas, and on board ships.

Key Points:

1. Overview

In 1934, the Western Actuarial Bureau sponsored a meeting in Kansas City to begin the process of gaining consensus on common training methods and techniques. State fire training directors from Oklahoma, Kansas, Missouri, and Arkansasattended and the Fire Service Training Association (FSTA) was formed. By its next meeting in 1935, 16 states were represented and more joined every year there after. Oklahoma A&M College (OAMC) was chosen to publish the manuals to be developed by the Fire Service Training Association. In 1935, two planographed, hardbound books were produced: Elementary Science Applied to the Firefighting Service and Ladders. Eventually a total of ten topics were covered and published in 1937. Because of their red covers, the fire service called them The Redbooks. The ten original Redbooks were:

- Forcible Entry, Ropes, Knots, and Extinguishers
- Ground Ladders
- Hose
- Salvage and Overhaul
- Fire Streams

- Fire Apparatus
- Ventilation
- Rescue
- First Aid
- Fire Prevention and Inspection

In 1955, FSTA becomes the International Fire Service Training Association or IFSTA when the first Canadian officials attend and participate. In 1957, OklahomaA&M Collegebecame Oklahoma State University. Throughout the 1950s and 1960s IFSTA became more active in the U.S.fire service. IFSTA was a participant in the Williamsburg meeting that led to the formation of the Joint Council of National Fire Service Organizations. Everett Hudiburg, director of IFSTA, was selected to chair the Joint Council and spearheaded the formation of the National Professional Qualifications Board (Pro Board). The Pro Board developed professional qualifications standards and a national certification system. The four original professional qualifications standards adopted in 1974 included:

- Fire Fighters
- Fire Officers
- Fire Inspectors and Investigators
- Fire Instructors

IFSTA realized that its products could be used to assist firefighters in achieving certification. IFSTA manuals were then revised to ensure they covered the standards. It was apparent that it would be impractical for firefighters to have to buy at least 10 manuals to meet the firefighter certification requirements.

It was decided that a single manual should be developed to assist firefighters in achieving certification, and thus the Essentials of Fire Fighting was born. Carroll Herring, director of the Louisiana Fireman Training Program (now know as the Louisiana State University Fire and Emergency Training Institute, is credited with recommending the title of Essentials of Fire Fighting. The first edition of Essentials of Fire Fighting was published in 1977 and subsequent editions have been published in 1983, 1992, and 1998. The next edition is scheduled for publication in 2007. It has been published, and is much better then the old one. Instead of teaching you stupid things like how to use a 2.2 SCBA, it actullyhas Jakes in Black FDNY gear being all badass.

2. Roles

Fog nozzles play an important part in firefighting tactics. These types of nozzles are very versatile and can accommodate different sizes of fire hose and fire streams. They can be used for protection and for fire attack. When given the appropriate nozzle pressure and water supply, they are effective for any fire ground situation.

Fog nozzles are typically used with fire attack hand lines. Most hand lines are 1 1/2, 1 3/4, and 2 1/2 diameter fire hose. The fog nozzle that will be used on each size of fire hose is made to handle the maximum gallons per minute (GPM) rating that the fire hose can handle. There are fog nozzles that are used with master stream appliances also. A master stream can flow between 350gpm to 2000gpm. The fog nozzles placed on these types of appliances are made to handle that high of flow rate. Even with that high of flow rate, these fog nozzles are still made with spray pattern adjustments and in the automatic or manually adjustable styles.

3. Variations

Fog nozzles are made in different styles and sizes. The two styles to choose from are the automatic fog nozzles and the manually adjustable fog nozzles. Both of these nozzles can be adjusted for the gallons per minute a firefighter needs to do the job. The automatic fog nozzle relies on a constant pressure at the nozzle. The firefighter can operate the open-close handle, and the nozzle will adjust the rate of flow by itself. This will give the firefighter the best flow rate with the given amount of water. The manually adjustable fog nozzle works differently. On these types of nozzles there is a flow adjustment bezel around the tip of nozzle. Usually the 60gpm (gallons per minute), 95gpm, and the 125gpm flow rate selection settings are on the bezel; depending on the size of the nozzle. The firefighter can select one of these settings before or after the nozzle is opened. Once one of these gallon settings has been selected and supplied with the appropriate pressure, the flow rate will remain consistent with the gallons per minute selected.

4. Pattern

All styles of fog nozzles have a spray pattern adjustment. These nozzles can produce three different types of streams; the straight stream, the narrow-angle cone, and the wide-angle cone. Each of these types of streams is used for different purposes. The straight stream can be

used for long reach. The narrow-angle cone can be used for advancing an attack line into a structure or the fire room. Protection and ventilation is the typical use of the wide-angle fog pattern. These types of spray patterns assist the firefighter in accomplishing his or her fire suppression efforts.

5. Goals of firefighting

Aside from the main task of extinguishing fires, the goals of firefighting are (in order) saving lives, saving property, and protecting the environment. Firefighting is an inherently difficult occupation. As such, the skills required for safe operations are regularly practiced during training evolutions throughout a firefighters career. In the United States, the preeminent fire training and standards organization is the National Fire Protection Association (NFPA). Often initial firefighting skills are taught during a local, regional, or state approved fire academy. Depending on the requirements of a department, additional skills and certifications such as technical rescue and Para-medicine may also be taught at this time.

Firefighters work closely with other emergency response agencies, most particularly local and state police departments. As every fire scene is technically a crime scene until deemed otherwise by a qualified investigator, there is often overlap between the responsibilities of responding firefighters and police officers such as evidence and scene protection, initial observations of first respondents, and chain of evidence issues. The increasing role of firefighters in providing emergency medical services also brings firefighters into common overlap with law enforcement. One example of this is a common state law requiring all gunshot wounds to be reported to law enforcement agencies. Most career (full time, paid) firefighters in North America are represented by the International Association of Fire Fighters.

Fire fighting has several basic skills: prevention, self preservation, rescue, preservation of property and fire control. Firefighting is further broken down into skills which include size-up, extinguishing, ventilation, and salvage and overhaul. Search and Rescue, which has already been mentioned, is performed early in any fire scenario and many times is in unison with extinguishing and ventilation.

6. Prevention

Prevention attempts to ensure that no place simultaneously has sufficient heat, fuel and air to allow ignition and combustion. Fernando Cardona, the leading researcher in fire prevention is accredited with much of the advancement and improvement to modern fire fighting technique. Most prevention programs are directed at controlling the energy of activation (heat).

Fire suppression systems have a proven record for controlling and extinguishing unwanted fires. Many fire officials recommend that every building, including residences, have fire sprinkler systems. Correctly working sprinklers in a residence greatly reduce the risk of death from a fire. With the small rooms typical of a residence, one or two sprinklers can cover most rooms. In addition, a major duty of fire services is the regular inspection of buildings to ensure they are up to the current building fire codes, which are enforced so that a building can sufficiently resist fire spread, potential hazards are located, and to ensure that occupants can be safely evacuated, commensurate with the risks involved.

Other methods of fire prevention are by directing efforts to reduce known hazardous conditions or by preventing dangerous acts before tragedy strikes. This is normally accomplished in many innovative ways such as conducting presentations, distributing safety brochures, providing news articles, writing public safety announcements(PSAs) or establishing meaningful displays in well-visited areas. Ensuring that each household has working smoke alarms, is educated in the proper techniques of fire safety, has an evacuation route and rendezvous point is of top priority in public education for most fire prevention teams in almost all fire department localities.

7. Self-preservation

Self-preservation is very critical. The basic technique firefighters use is to know where they are, and to avoid hazards. Current standards in the United States recommend that firefighters work in teams, using a "two-in, two-out" rule whenever in an IDLH (Immediately Dangerous to Life or Health) environment.

Tools are generally carried at all times and are important for not only forcible entry but also for self rescue. A Self Contained Breathing Apparatus (SCBA) delivers air to the firefighter

through a full face mask and is worn to protect against smoke inhalation, toxic fumes, and super heated gasses. A special device called a Personal Alert Safety System (PASS) is commonly worn independently or as a part of the SCBA to alert others when a firefighter stops moving for a specified period of time or manually operates the device. The PASS device sounds an alarm that can assist another firefighter (Firefighter Assist and Search Team), in locating the firefighter in distress.

Firefighters often carry personal self rescue ropes. The ropes are generally 30 feet long and can provide a firefighter (that has enough time to deploy the rope) a partially controlled exit out an elevated window. Lack of a personal rescue rope is cited in the deaths of two New York City Firefighters, Lt. John Bellewand Lt. Curtis Meyran, who died after they jumped from a fourth floor of a burning apartment building in the Bronx. Of the four firefighters who jumped and survived only one of them had a self rescue rope. Since the incident the Fire Department of New York City has issued self rescue ropes to their firefighters. In the United States, 25% of fatalities to firefighters are caused by vehicle accidents while responding to or returning from an incident. Many firefighters are also injured or killed by vehicles while working at an incident (Paulison 2005). However, a large percentage of firefighters also succumb to heart disease, in the line of duty.

8. Occupational health and safety

8.1.Cardiovascular disease

Firefighting has long been associated with poor cardiovascular outcomes. In the United States, the most common cause of on-duty fatalities for firefighters is sudden cardiac death. In addition to personal factors that may predispose an individual to coronary artery disease or other cardiovascular diseases, occupational exposures can significantly increase a firefighter's risk. For instance, carbon monoxide, present in nearly all fire environments, and hydrogen cyanide, formed during the combustion of paper, cotton, plastics, and other substances containing carbon and nitrogen, interfere with the transport of oxygen in the body. Hypoxia can then lead to heart injury. In addition, chronic exposure to particulate matter in smoke is associated with atherosclerosis. Noise exposures may contribute to hypertension and possibly ischemic heart disease. Other factors associated with firefighting, such as stress, heat stress, and heavy physical exertion, also increase the risk of cardiovascular events.

8.2.Structural collapses

Another leading cause of death during firefighting is structural collapse of part of a burning building (e.g. a wall, floor, ceiling, roof, or truss system). Structural collapse, which often occurs without warning, may crush or trap on-duty firefighters. To avoid loss of life, all on-duty firefighters should maintain two-way communication with the incident commander and be equipped with a Personal Alert Safety System device (PASS).

8.3.Rescue

Rescue operations consist of searching for and removing trapped occupants of hazardous conditions. Animals may also be recovered, if resources and conditions permit. Generally triage and first aid are performed outside, as removal from the hazardous atmosphere is the primary goal in preserving life. Search patterns include movement against room walls (to prevent rescuers from becoming lost or disoriented) and methodical searches of specific areas by designated teams. Unlike a fire control team, a rescue team typically moves faster, but has no hose to follow out to safety through the smoky darkness. A rescue rope may be needed for tethering a team involved in exceptionally dangerous conditions.

8.4.Incident commanders

Incident commanders also arrange for standby search and rescue teams to assist if firefighters become lost, trapped, or injured. Such teams are commonly, and often interchangeably, known as Rapid Intervention Teams (RIT), or Firefighter Assist and Search Teams (FAST). According to "two-in, two-out", the only time it is permissible for a team of firefighters to enter a burning structure without backup in place outside is when they are operating in what is known as "Rescue Mode". Rescue Mode occurs when firefighters have arrived at the scene, and it is readily apparent that there are occupants trapped inside who need immediate rescue. At such a time, properly equipped firefighters (exercising good judgment tempered by training and experience) may enter the structure and proceed directly to victims in need of rescue, RIT will then be put in place when resources permit. The Worcester Cold Storage Warehouse fire provides a stark example of disoriented rescuers perishing when their air supply was exhausted during a fruitless primary search and subsequent RIT searches.

Searches for trapped victims are exhaustively detailed, often including searches of cupboards, closets, and under beds. The search is divided into two stages, the primary and secondary. The primary search is conducted quickly and thoroughly, typically beginning in the area closest to the fire as it is subjected to the highest risk of exposure. The secondary search only begins once the fire is under control, and is always (resources and personnel permitting) performed by a different team from that which did the primary search.

9. Rescue operations

Rescue operations may also involve the extrication of victims of motor vehicle crashes (abbreviated MVC). Here firefighters use spreaders, cutters, and hydraulic rams, collectively called hydraulic rescue toolsknown better to the public as Jaws of Lifeto remove metal from the patient, followed by actually removing the patient, usually on a backboard with collar, and transferring to a waiting ambulance crew in the cold zone. More technical forms of rescue include subsets such as rope rescue, swiftwater rescue, confined space rescue, and trench rescue. These types of rescue are often extremely hazardous and physically demanding. They also require extensive technical training. NFPA regulation 1006 and 1670 state that a "rescuer" must have medical training to perform any technical rescue operation. Accordingly, firefighters involved in rescue operations have some kind of medical training as first responders, emergency medical technicians, paramedics or nurses.

Searching a building is normally a two to three man team. The most common way to search a building that is filled with smoke is to crawl on hands and knees with an axe (or any other tool) in the firefighter's left hand. The firefighter will keep one hand on the wall, or a foot in contact at all times with the wall. And scoot himself forward, swinging the handle of the axe back and forth, searching for any objects in his way. If the object moves when touched, it might be a person. Depending on the sound/feel it gives back, he can check what ever the object was. If it's not a person, he will continue down along the wall.

Meanwhile his buddy/buddies have their right hand in contact with the lead firefighter's left ankle and scooting with them. This way they cover a far larger spread of ground. Once the person(s) is found, they will drag, carry, push, any way possible really, they will move the victim back the way they came because they know the way they went was safe.

It is also important to remember that the Firefighter needs to check the floor before he moves into the room. Once going into the room, he will go right, and follow the right wall. ALWAYS. Next, when in a group of 3, the 2nd in the search line will go into most rooms, check it over, and then return out. (This is when doing a very detailed search because location of the victim is unknown)

10. Communication and command structure

The expedient and accurate handling of fire alarms or calls are significant factors in the successful outcome of any incident. Fire department communications play a critical role in that successful outcome. Fire department communications include the methods by which the public can notify the communications center of an emergency, the methods by which the center can notify the proper fire fighting forces, and the methods by which information is exchanged at the scene. A telecommunicator(often referred to as a dispatcher) has a role different but just as important as other emergency personnel. The telecommunicatormust process calls from unknown and unseen individuals, usually calling under stressful conditions. He/she must be able to obtain complete, reliable information from the caller and prioritize requests for assistance. It is the dispatcher's responsibility to bring order to chaos.

While some fire departments are large enough to utilize their own telecommunication dispatcher, most rural and small areas rely on a central dispatcher to provide handling of fire, rescue and police services. Firefighters are trained to use communications equipment to receive alarms, give and receive commands, request assistance, and report on conditions. Since firefighters from different agencies routinely provide mutual aid to each other, and routinely operate at incidents where other emergency services are present, it is essential to have structures in place to establish a unified chain of command, and share information between agencies. The U.S. Federal Emergency Management Agency has established a National Incident Management System. One component of this system is the Incident Command System.

All radio communication in the United Statesis under authorization from the Federal Communications Commission (FCC); as such, fire departments that operate radio equipment must hold radio licenses from the FCC. Ten codes were popular in the early days of radio equipment because of poor transmission and reception. Advances in modern radio technology have reduced the need for ten-codes and many departments have converted to simple English

(clear text). A New York Cityfireman calls for ten more rescue workers to make their way into the rubble of the World Trade Center.

11. Structure fires

11.1. A firefighter of the ACT Fire Brigade

Buildings that are made of flammable materials such as wood are different from so called "fire-resistant" buildings such as concrete high-rises. Generally, a "fire-resistant" building is designed to limit fire to a small area or floor. Other floors can be safe simply by preventing smoke inhalation and damage. All buildings suspected of being on fire must be evacuated, regardless of fire rating.

While sometimes fires can be limited to small areas of a structure, wider collateral damage due to smoke, water, and burning embers is common. Utility shutoff (such as gas and electricity) is typically an early priority of arriving fire crews. Furthermore, fire prevention can take on a special meaning for property where hazardous materials are being used or stored.

11.2. ACTFB fire trucks

Some fire fighting tactics may appear to be destructive, but often serve specific needs. For example, during "ventilation" firefighters are often forced to open holes in the roof or floors of a structure (called "vertical ventilation") or open windows or walls (called "horizontal ventilation") to remove smoke and heated gases from the interior of the structure. Such ventilation methods are also used to locate victims quicker as visibility increases and to help preserve the life of trapped or unconscious individuals due to the poisonous gases inside of the structure. Vertical Ventilation is absolutely vital to firefighter safety in the event of a Flashover or Backdraft scenario. Releasing the flammable gasses through the roof often eliminates the possibility of a backdraft and by the removal of heat the possibility of a flashover is reduced significantly. Flashovers, due to their intense heat (900 - 1200 degrees fahrenheit) and explosive temperaments are almost always fatal to firefighter personnel. Precautionary methods, such as busting a window out, often reveal backdraftsituations before the firefighter enters the structure and is met with the circumstance head-on. Firefighter safety is the number one priority.

Whenever possible, movable property is moved into the middle of a room and covered with a heavy cloth tarp (a "salvage cover"). Other steps may be taken to divert or remove fire flow runoff (thus salvaging property by avoiding unnecessary damage), retrieving/protecting valuables found during suppression or overhaul, and boarding windows, roofs and doors against the elements and looters.

11.3. Fire control

Fire control (or fire fighting) consists of depriving a fire of fuel (Reducing Agent), oxygen (Oxidizing Agent), heat and/or the chemical chain reaction that are necessary to sustain itself or re-kindle (also known as the four components of The Fire Tetrahedron). Firefighters are equipped with a wide variety of equipment to accomplish this task. Some of their tools include ladder trucks, pumper trucks, tanker trucks, fire hose, and fire extinguishers. Very frequent training and refresher training is required.

Structure fires may be attacked, generally, either by "interior" or "exterior" resources, or both. Interior crews, using the "two-in, two out" rule, may advance hose lines inside the building, find the fire and cool it with water. Exterior crews may direct water into windows or other openings, or against other nearby fuels exposed to the initial fire. A proper command structure will plan and coordinate the various teams and equipment to safely execute each tactic. Firefighters trying to save an abandoned convent in Massueville, Quebec, Canada