Fire Alarm, Emergency Communication, Integration, and CyberSecurity

INTRODUCTION

Welcome to Fire Alarm, Emergency Communication, Integration and CyberSecurity

Project managers, you have many different backgrounds of training which are mostly non-electrical. Yet your project authority and responsibility includes the engineers and technicians who design, construct or maintain systems. You wish that you possessed a Big Picture view of fire alarm and related systems and subjects so that you could hear and speak with your specialists more effectively.

Clarification to specialist engineers and technicians: Thank you for your interest in a big picture. A big picture puts perspective on your detail work. However this course does not teach you how to design, provide or maintain systems. Please refer to your specialty's training for details of design, provision or maintenance.

Here is the large view of this course.

- Damage, destruction and death drive the development of fire fighting, standards, and systems. Yesterday's pain teaches us today's wisdom.
- Each newer type of system answers more firefighter questions.
- Fire Alarm systems now involve multiple other systems.
- Digitalization has mushroomed data management and cybersecurity.

WHOM DOES A FIRE AFFECT?

- A fire affects EVERYONE.
- This chart shows ten major subjects containing 43 issues for 21 stakeholders.
- The highest cost is personal injury to persons, familes and friends.
- Others in the community pitch in to help.
- Firefighters and law enforcement risk their lives, health and families to help.
- The judicial and financial systems deal with the cause and effect.
- The construction industry rebuil ds, hopefully with better fire resistance.
- The writers of law codes try to improve the requirements.
- Most everyone pays taxes to fund the outcome.

FIRE STAKEHOLDERS AND THEIR INTEREST

as perceived by Walter W. Henry, P.E. cprt. 03-09-2017

Fire affects each stakeholder in some way.

The quantity of Stakeholders, Subjects and Issues is amazing when we think about it.

SUBJECT >	INITIAL FACILITY					FIRE				PERSONAL			TRAUMA CARE AND HEALTH CARE			UTILITIES				LIFE SAVING			FIREFIGHT			FIRE RESISTANCE OF THE FACILITY								NEW CONSTRUCTION OR REBUILD							FINANCIALS			
ISSUE >	STRUCTURES	GROUNDS	PROCESS	PRODUCTS	SERVICE	CAUSE	PURPOSE	METHOD	REASON	LIFE	HEALTH	BELONGINGS	EMOTIONAL	MENTAL	PHYSICAL	ELECTRICITY	MOTOR FUEL	WATER	GAS-NATURAL, LP	LIFE SAVERS	EQUIPMENT	SUPPORT	FIRE FIGHTERS	WATER	EQUIPMENT	SPRINKLER	FIRE ALARM	SECURITY	STAIRS	ELEVATORS	COMMUNICATION	FLOOR PLAN	VISION FOR SAFETY	DESIGN	MANUFACTURE	CONSTRUCTION	TESTING	MAINTENANCE	REPAIRS	LIVELIHOOD	TAXES	MORTGAGE	R. O. I.
EVENT																																											
FIRE STARTER (IF DELIBERATE)	Y	Y	Y	Y	Y	Y	Y	Y	Y							Y	Y	Y	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y									Y		
OCCUPANTS AND FAMILIES						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
BUILDING OWNER	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FIREFIGHTERS						Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		
LAW ENFORCEMENT	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y		Y																			Y		
FIRE MARSHAL	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
HEALTHCARE COMMUNITY													Y	Y	Y					Y	Y	Y																			Y		
NEIGHBORS						Y	Y	Y	Y	Y	Y	Y	Y	Y	Y																											Y		
COMMUNITY						Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y		
LEGALITIES																																											
JUDICIAL SYSTEM	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y					Y		Y																			Y		
INSURANCE COMPANIES	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
INVESTORS																																									Y		Y
BANKERS																																									Y	Y	
REBUILD																																											
MANUFACTURERS						Y	Y	Y	Y	Y	Y	Y				Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		
DESIGNERS						Y	Y	Y	Y	Y	Y	Y				Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		
CONSTRUCTORS										Y	Y	Y				Y	Y	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y		
MAINTAINERS										Y	Y	Y				Y	Y	Y	Y							Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
UTILITY COMPANIES																Y	Y	Y	Y																						Y		
IMPROVE																																											
CRIMINAL CODES	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y					Y		Y																			Y		
BUILDING CODES	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y								Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
FIREFIGHTING CODES	Y	Y	Y	Y	Y											Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		

First we need to understand

SOME DEFINITIONS

AHJ

- "AHJ" indicates the Authority Having Jurisdiction, usually the Fire Marshal.
- The AHJ bears responsibility regarding public safety
- The AHJ wants to help the public be safe and successful.
- The AHJ is appreciates a cooperative attitude from project people.
    - Send the AHJ a 100% set of CDs during final design.
    - Get the AHJ's CD sign-off with notes of items to consider.
    - Give timely notice of inspections.
    - Consider AHJ inspection comments and comply as you can.
- Keep the AHJ notified of major inspections in a timely manner, respect AHJ comments, and you will find the AHJ being helpful.
- Remember, the Owner must receive AHJ signoff permission for occupancy.

Junction Box

- "Junction Box" is an enclosure which contains and protects wiring, devices and connections, and supports devices mounted upon it.
- Fire alarm boxes include junction boxes in conduit runs, boxes supporting devices like pull stations or horn-strobes, or the enclosures of fire alarm panels.
- Some specifications require boxes and covers painted red all over before installation.
- Other specifications require a FA fire alarm label on the box cover.

Contract Documents (CD's)

- Contract Documents are the written agreement between the Owner and the Contractor.
- Contract Documents include many items such as these.
    - Agreements define expectations between the Owner and other parties.
    - Design drawings indicate items, quantity, and locations.
    - Design specifications describe materials, performance, installation methods and testing.
    - Bid Addenda and Change Orders modify the Work. ,
    - Submittal Data reveals the Contractor understanding of the Work.
    - Payment Requests and Partial Payments keep the Contractor funded.
    - Final Acceptance is granted by the Owner after the Work is complete.

Even with computers, printed fullsize drawings are useful. Drawings allow one to thumb through, see everything, compare, and mark-up.

Some Purposes of Contract Documents

- CDs guide the parties in matters of the Work.
- The Owner expects all bidding parties to bid the same Work.
- The Work is specific. The Owner expects that Work, no more, no less.
- The Contractor can point to the CD if the Owner asks for more.

Specifications books cover projects in various stages of construction or held for warrantee reference.

The Contractor

- The Contractor is the single party who agrees with the Owner to construct “the Work”.
- “The Contractor” subcontracts with specialty contractors, suppliers and manufacturers, and manages them.
- Frankly, the Contractor has a tough job to turn a sow’s ear into a silk purse.
- This photo shows the Engineer and the Contractor observing the Work.

Agreements are made in writing to clarify details and help us remember. However, the handshake indicates our heart’s determination to carry through as agreed, and that our word is our bond.

Commissioning Agent

- "CX agent" indicates a Commissioning Agent.
- The Commissioning Agent is the Owner's designee to verify that a facility conforms to Contract Documents and is suitable for building occupancy.
- The Owner's agreement with the CX agent specifies a scope of work and methodology.
- The CX agent might perform these duties.
    - Inspect materials and workmanship for conformance to CDs.
    - Test building systems for performance as specified.
    - Formally train the Owner's maintenance and operation staffs.
    - Periodically re-inspect the building.
    - Periodically re-train the staff, especially new staff.

In this photo, the Commissioning Agent and the Contractors discuss a matter to reach understanding of the situation.

Device

- "Device" is a generalized term for fire alarm equipment which mounts on a junction box.
- One annunciation device is a speaker/strobes as pictured.
- Some initiating devices are pull stations as pictured, smoke detectors, or heat detectors.

Engineer

- An Engineer is a designer who artfully contrives building system(s).
- For an existing facility, the Engineer contracts and performs pre-design discovery.
- Then the Engineer agrees with the Owner for a scope of work.
    - Design the fire alarm and other systems,
    - Prepare the related Contract Documents,
    - Observe the construction work on those systems for conformance to CDs.
    - Perform other work listed in the agreement's scope of work.
    - Serve as the Commissioning Agent on those systems, if so agreed.
    -

This image shows an Engineer's workstation.

The computer calculates sizing, assembles specifications, handles construction management documents, answers Requests for Information, studies Requests for Partial Payment or proposed Change Orders, communicates, and researches manufacturer's literature.

The Engineer designs with red ink on 11 by 17 or full size floor plan drawings, and delivers markups to the drafter.

The Engineer prints the drafted work, compares the drafting to markups, highlights correct items in green, and red-marks incorrect items. Then the Engineer marks other edits caused by latest Architect changes, or the Engineer's own design upgrades.

After re-drafting and re-checking, when all linework is highlighted green, the design is checked and correct.

Fire

- Fire is the rapid, heat-releasing, self-perpetuating, oxidation of a solid, liquid or gas.
- Smoke is the chemically converted mix of liquid, solid and gas which are released by fire.

Fire Alarm System

- A Fire Alarm System is an interactive group of equipment and cabling designed to
  - automatically or manually detect fire or its products,
  - notify responders and occupants,
  - annunciate some details about the fire,
  - and perform certain functions within building systems.
- A Fire Alarm System also contributes to an Emergency Communications System.
- This NOTIFIER SFP-2402 conventional FA system indicates basic elements of a fire alarm system, to give a concept.

Credit: Image is used with permission of Honeywell. Image "SFP-2402/04 FIRE ALARM CONTROL PANELS" is found in Notifier's "conventional_solutions_pdf.pdf"

Firefighter

- A firefighter is a rescuer with a service attitude who is trained
  - to contain, control or extinguish hazardous fires
  - and to rescue people from dangerous situations.
- Some settings are structures, vehicles, and exterior locations.
- Some firefighters are trained in Emergency Medical Services (EMS).
- Fire alarm systems and security systems can assist firefighters.
- Dangers to firefighters include are heat stress, structural collapse, heavy exertion, and toxic gas.

Inspection

- "Inspection" verifies that the Work conforms to the Contract Documents, and INSTRUCTS the Contractor to perform correction or completion.
- The Owner has the power and delegates authority for inspection, as follows.
  - The Owner inspects the designs in advance of construction.
  - The Owner inspects the Contractor's work during construction.
  - The Architect and other Project Managers inspect.
  - The Contractor inspects their own work, and
  - The Contractor inspects the work of their Subcontractors, Suppliers and Manufacturers.
  - Commissioning Agents inspect the Work.
- If shown in scope of work, an Engineer "OBSERVES" their own design as installed and writes recommendations to the Owner and Project Manager, for them to edit and enforce.

This Project Manager compares a construction drawing to the installed work.

Observation

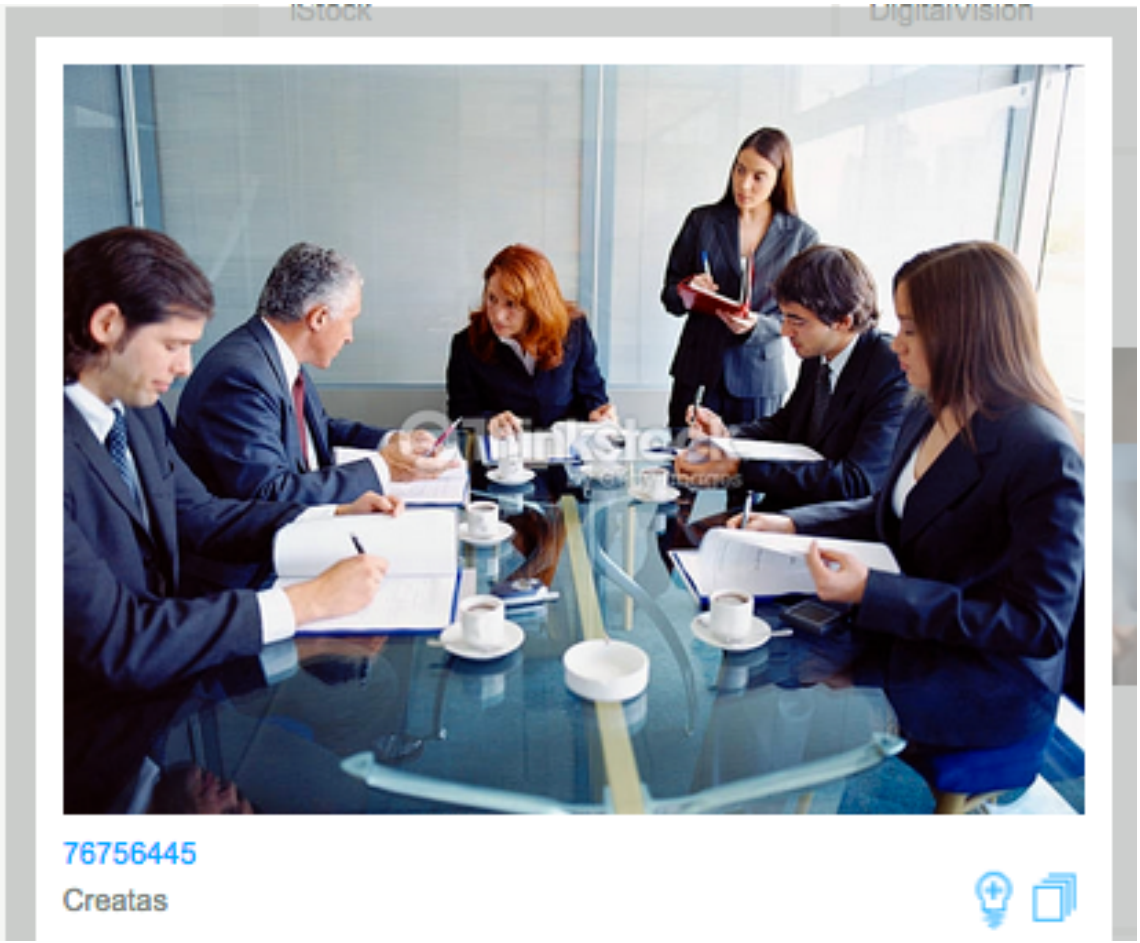
- Who cares whether one says that an Engineer Inspects or Observes? Insurance companies care, for liability reasons. So why is there a difference?
- The Engineer does NOT write an an "Inspection Report" direct to the Contractor.
- The Engineer writes an "Observation Report" to the Owner through the Project Manager. They often edit the report before sending it to the Contractor. Why? They have financial or technical coordination reasons outside the Engineer's knowledge or control.
- Contractors honor Engineers with Implied Power. What's Implied Power?
    - Most Contractors think if an Engineer makes a question or comment on site during an Observation, that is an instruction. Contractors make notes with the idea to proceed.
    - Problem is that if the Project Manager issues a valid instruction and it's different, the Contractor may ask payment for cost and time to re-do the work.
    - This Engineer learned to tell this to the Contractor escorting him. "Don't act on our conversation. The Architect can edit these notes. Wait for the official Owner Inspection Report and act on that."
- In times past, Owners wanted the Engineers to "OBSERVE" their own design as installed since the Engineers best know their own designs. Beginning in the 1990's, the industry promoted Commissioning Agents to inspect the work, thinking that some Engineers may be partial. The choice depends upon the individual qualities of the Owners, Engineers and Commissioning Agents.

This Engineer is asking these Contractors to show him how a certain piece of work was installed.

Owner

- "Owner" is the person or organization who possesses title, authority, and power to make decisions and agreements regarding the property.
- An Owner may be a public or private entity.
- The Owner designates limited authority and responsibility with reward through formal agreements with other parties.
- Oftentimes "the Owner's Representative" meets with the Engineer and Contractors on behalf of the Owner's organization.

In this image, the Owner, Architects and some Engineers may be discussing Owner criteria, building space and their green build program.



Panel

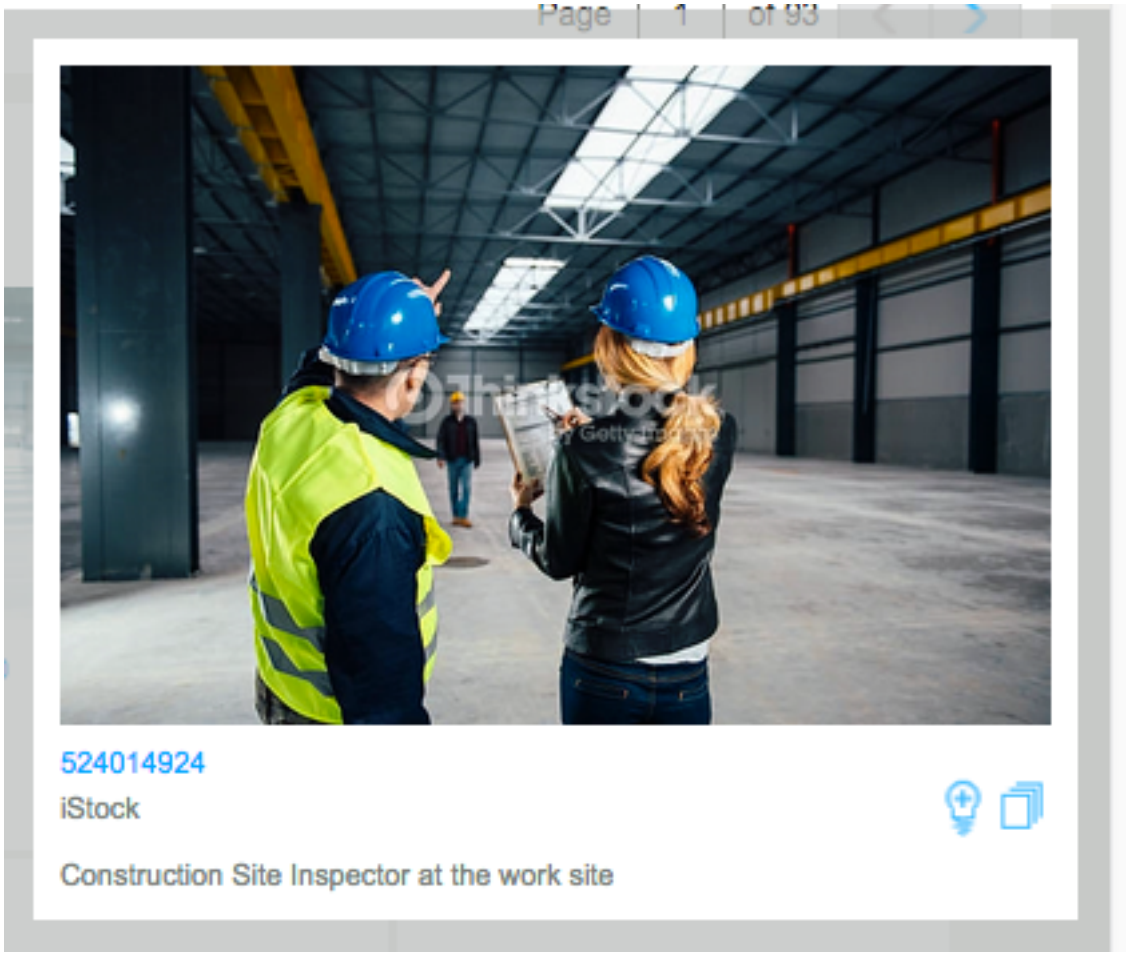
- "Panel" is a generalized term for a wall mounted enclosure which contains equipment.

- Examples are electric power panels, Fire Alarm Control Panels , fire alarm extender panels, power supply panel, or battery cabinet.

Project Manager

- A Project Manager is a person to whom the Owner designates authority and responsibility to lead and guide the initiation, planning, execution and closing of a project. Function includes but is not limited to the creation and fulfillment of Contract Documents.
- The PM manages the project scope, people, resources, and status.

This picture can indicate a Contractor's Project Manager discussing the skylight with a Subcontractor. Why is she holding a clipboard? Because the job isn't finished until the paperwork's done.



Project Managers in Organizations

- The Owner assigns one "Owner Representative" to represent the Owner, tenants, and department managers who want to walk on site and give instructions.
- The Design Manager may be an Architect. If the project is primarily a Fire Alarm or another system, then that Engineer will probably be the Design Project Manager.
- The Construction Manager may be a General Contractor, a Construction Manager, or the Supplier of a specialized system.

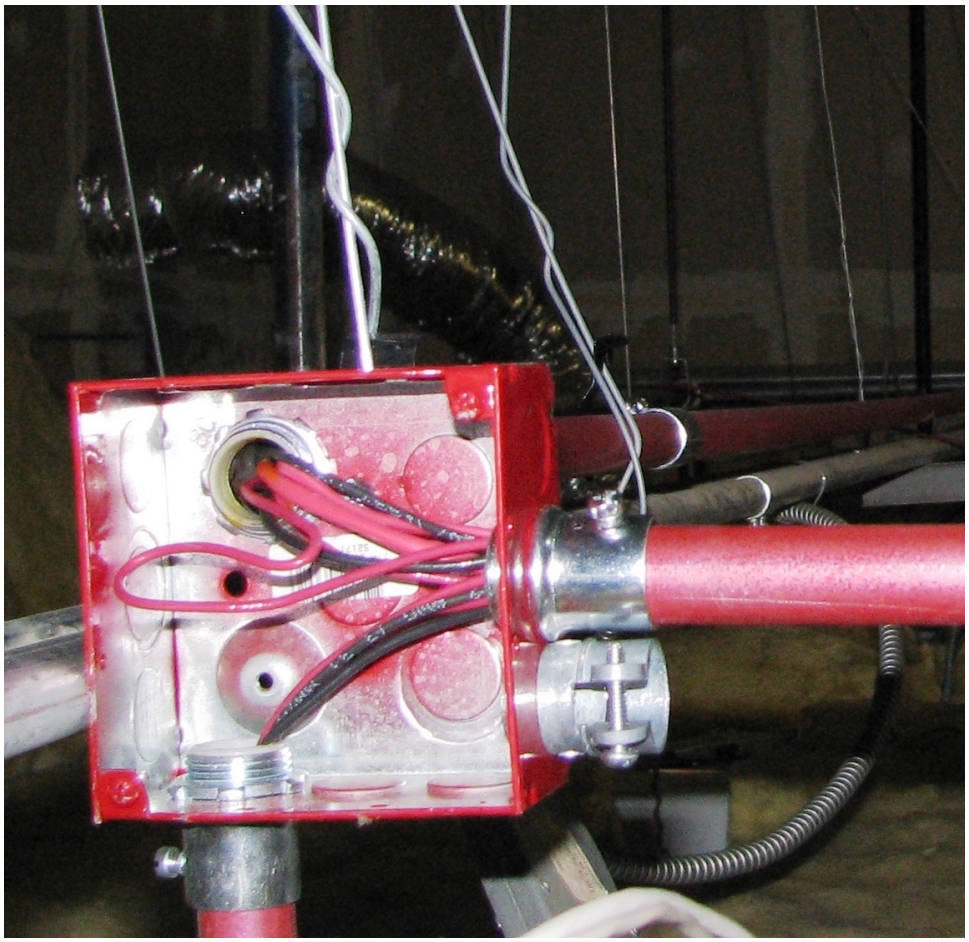
In this office project, the Mechanical and Electrical Engineers met with the General Contractor and trade Subcontractors on-site. The Electrical Engineer also designed the fire alarm extension of the existing building fire alarm system.

Credit: photo by Walter W. Henry, P.E., 2004

Circuits

- Wiring, Circuiting, Circuits, or Cables are electrical power or signal conductors between a source and a destination.
- The Specification describes each type of cable.
- Specify that fire alarm boxes be red all over before installation.
- Factory-painted red conduit is preferable to on-site spraying.

An Engineer observing the pictured box would make this note. "On the red fire alarm box above space 23, plug the hole and provide a cover."



"The Work"

- " The Work" indicates the construction, services and deliverables shown in the Contract Documents.
- The term "the Work" comes in handy to save a lot of words in the CDs and discussions.

This Engineer designed new fire alarm, power, and lighting inside this historic church building renovation.

House Fire

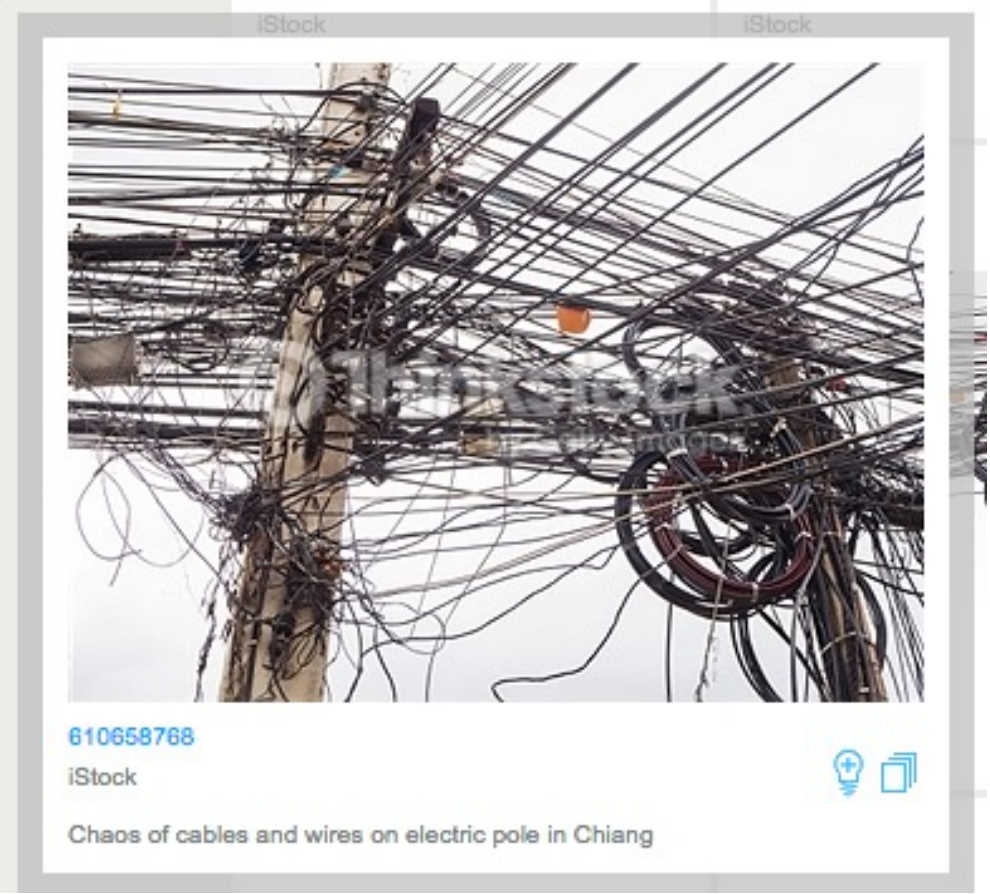
- This video imparts a sense of why we provide fire alarm systems.

WHY DID PEOPLE PUSH FOR SAFETY STANDARDS?

- As industry mechanized and electrified, fire multiplied.
- The general public, Owners, and insurance companies became horrified with the losses and misery to persons and property.
- During the late 1800's,
    - local entities attempted diverse safety standards
    - but there were no uniform national standards.

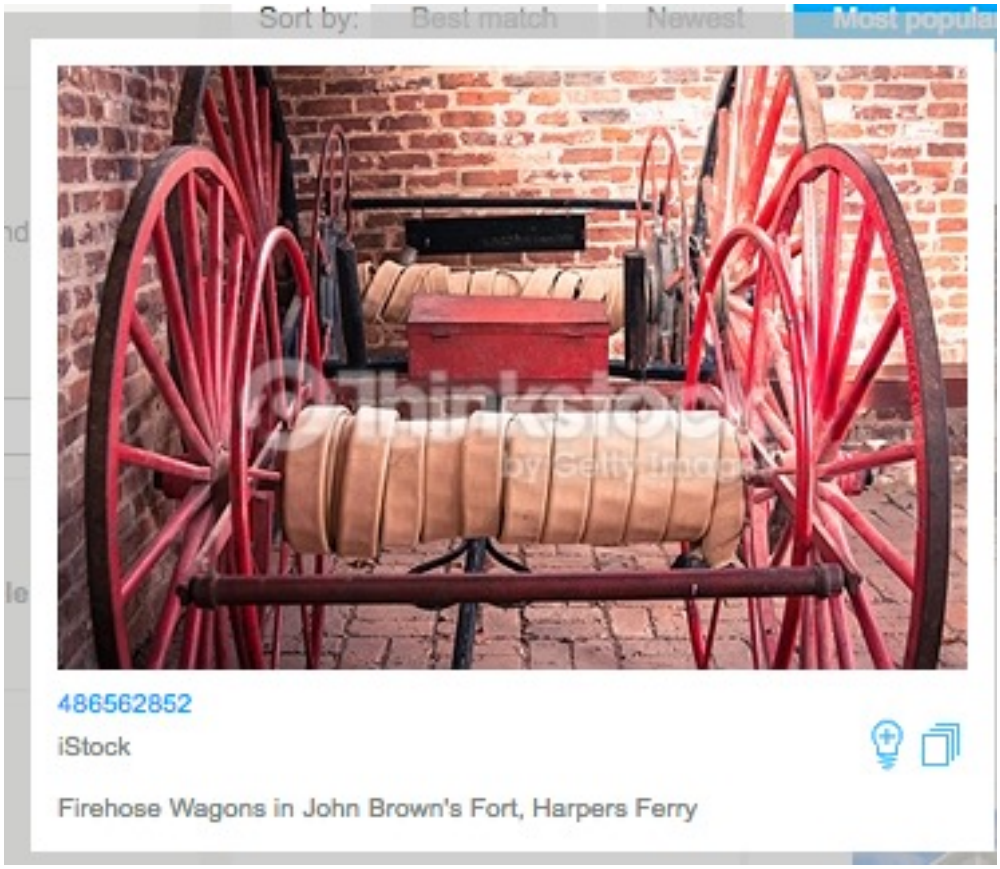
Electric System Challenges of the 1800's

- Electricians became tangled into masses of disorderly wiring and were electrocuted.
- Wiring problems caused fires since fuses and circuit breakers were non-existent for a time.



Firefighting System Challenges Into the Early 1900's

- Fire alarm reporting systems were new and rare.
- Firefighting equipment had low power and low capacity.
- Hundreds of fire hose connectors were non-standardized.
    - As a result, one city had trouble helping another city hose down a fire.
    - A city could not economically upgrade because it was "locked in" to one manufacturer's unique designs.



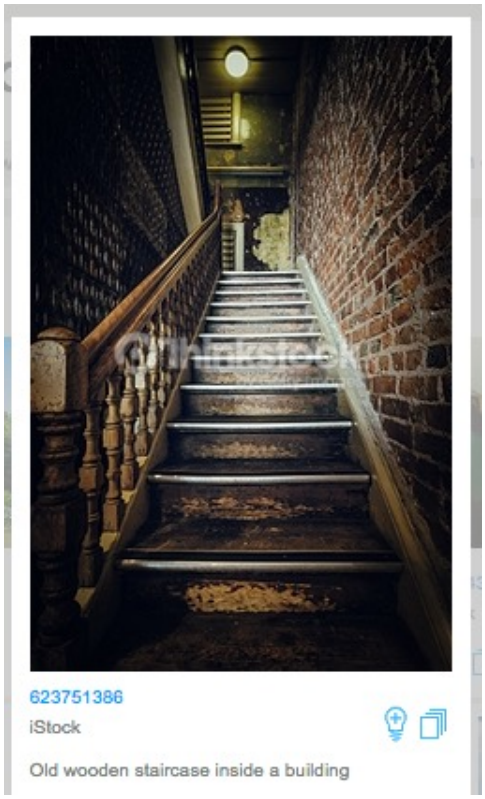
The Great Baltimore Fire of 1871

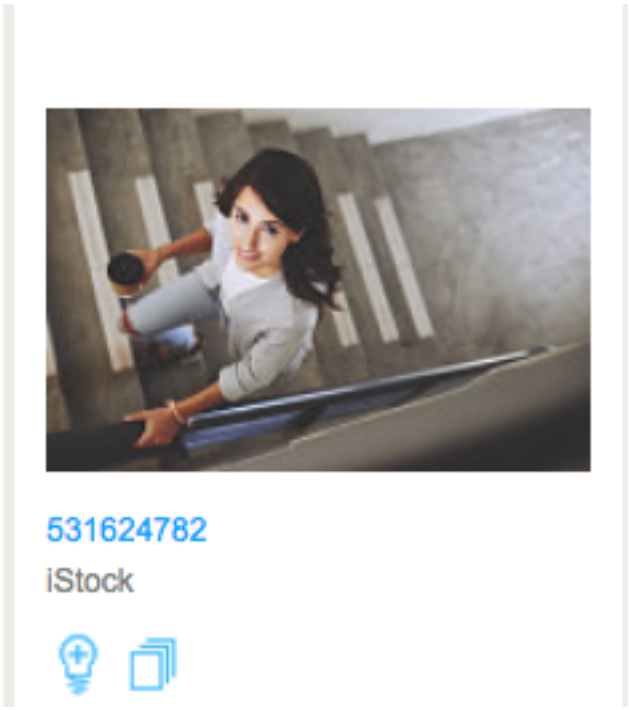
Fires regularly ravaged significant structures and great cities. For just one example,

- The Great Baltimore Fire of 1904 was the most destructive fire in the United States
- since the Great Chicago Fire of 1871. Involving about 140 acres,
- More than 1500 buildings were leveled and some 1000 were severely damaged
- Firefighters from other cities rushed in to assist
- but discovered that their hose connectors would not fit the hydrants.
- There was no nationwide standard for hose connectors.

Facilities Inhibited Fire Exit

- Egress halls materials and finish were flammable.
- Wooden stairs acted as flammable fire chimneys to multiple floors.
- Some fire escapes were unsafe.
- Elevators might trap people during a fire situation.
- Some fire hose valves were rusted shut and some fire hoses were rotten without inspection or repair.





LaSalle Hotel Fire

- Two major fires especially impacted modern fire codes.
- The LaSalle Hotel in Chicago, Illinois was built by 1901, Chicago's largest and most luxurious hotel at the time, making a claim of "safest hotel".
    - On June 5, 1946 fire began in the cocktail lounge then killed 61 people. The fire department was notified about 20 minutes after the fire began. By then the highly varnished wood paneling caused thick black smoke that caused more deaths than did flames.
    - The hotel was rebuilt and re-named by 1947, and operated into 1976.

Winecoff Hotel Fire

- The Winecoff Hotel in Atlanta, Georgia opened in 1913, was advertised as “fireproof”.
  - The hotel was built under 1911 Atlanta Building code. The hotel had a steel structure, a central fire alarm system manually operated by the front desk attendant, and a standpipe hose rack at each floor. Only one non-combustible stairway served all floors. Partitions were hollow clay tile covered with plaster. Corridors and rooms had combustible finishes.
  - There were no fire escapes, fire doors or sprinkler system.
  - Subsequent fire codes upgraded requirements, but Winecoff was “grandfathered” in.
  - The Winecoff Hotel fire of December 7, killed 119 hotel occupants including the hotel owners, injured about 65 persons, and became the deadliest hotel fire in United States history. The fire started on third floor. All occupants above floor third floor were trapped. The hotel was within two blocks of two engine and ladder companies. It is said that a bellboy sensed a problem and told the desk attendant, who tried to phone each of hundreds of occupants, and made one call to a fire station. Firefighters arrived within 30 seconds of the desk attendant’s phone call. Firefighters caught some jumpers in nets. But thirty two people died by jumping or trying to descend ropes made of bedsheets.
  - Fire, heat and smoke travelled the stairwell into corridors then rooms. Firefighters were hampered by people either trapped or jumping.\
  - Within about 20 minutes from a bellboy’s warning to the firefighter’s arrival, fire had too far progressed.

How Did Hotel Fires Affect Codes?

- President Harry Truman required a national conference on fire prevention. Then fires at these and other hotels tremendously impacted fire safety codes.
- The Building Exits Code of 1948 addressed fire detection, fire warning, the combustiblilty of finishes, and the number of people in a building.
- These fires and other fires began serious discussions about the enforcement of the latest fire codes upon older properties.

About the photo: Harry S. Truman was the thirty-third President of the United States of America from 1945 through 1953. He oversaw the end of World War 2 and the Berlin Airlift. The photo depicts President Truman authorizing U.S. entry into the Korean War, Dec. 16, 1950.

Image: President Truman authorizing U.S. entry into the Korean War, Dec. 16, 1950.

How Did Hotel Fires Affect Advertising and Fire Alarm Systems?

- Insurance companies used the term "Fireproof construction" meaning that a building would not collapse by fire. Hotels advertised utilizing that term. Then customers assumed that "fireproof construction" would protect their persons and personal property.

- It is said that Georgia Governor Ellis Arnall made this statement. "Responsible agencies should prohibit the use of the word "fireproof" when a hotel is not really fireproof, as the Winecoff obviously was not."

- Automatic Detection and Response were demanded. Desk attendants had neither training nor time to detect fire or announce fire to hundreds of occupants or a fire station. In addition, as demonstrated at Winecoff Hotel and schools, fire could conflagrate within a few minutes. Therefore detectors, annunciators, pull stations, and automatic notification to the fire station congealed as "Relay" type fire alarm systems during the 1930's through the 1980's.

- Stories about fires demonstrate that fire codes and systems are built upon damage, destruction and death, imparting to us a serious sense of significance in our fire alarm work.

President Truman and Governor Arnall set an example that a president and a governor can motivate "the public", companies and organizations to get moving in a good direction.

Ellis Arnall was governor of Georgia U.S.A. from 1943 through 1947. Governor Arnall brought remarkable progressive reforms to Georgia.

STANDARDS

NFPA

- The National Fire Protection Association was established in 1896 as an international nonprofit organization. The mission of the NFPA is to reduce the worldwide burden of fire and other hazards on the quality of life
- by providing and advocating **consensus** codes and standards, research, training, and education.
- Some NFPA standards are adopted by government entities, making codes which are mandatory and enforceable.
- "The public" provides wisdom of learning and experience into these "concensus codes".

In the photo, one can see that this company's people are serious about their National Fire Codes.

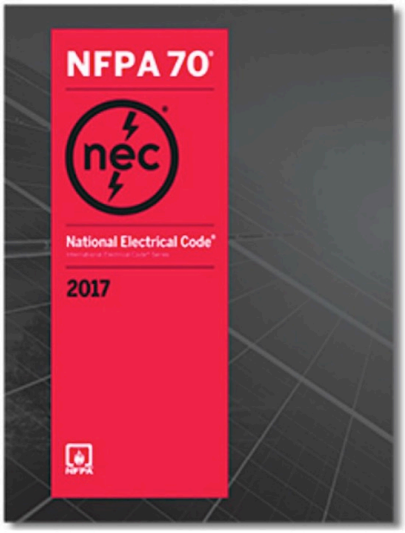
Why does the NFPA matter to us?

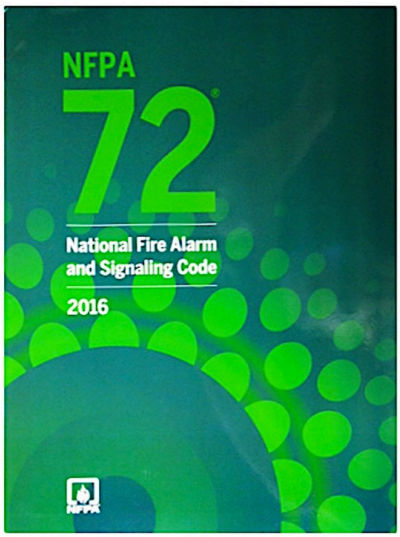
- NFPA develops, publishes, and disseminates
  - at least 377 consensus codes and standards
  - intended to minimize the possibility and effects of fire and other risks.
  - NFPA standards are updated each three years, sequenced among titles.
- NFPA is a leading advocate of fire prevention and an authoritative source on public safety with standards covering a wide range of indoor and outdoor activities, equipment and facilities.

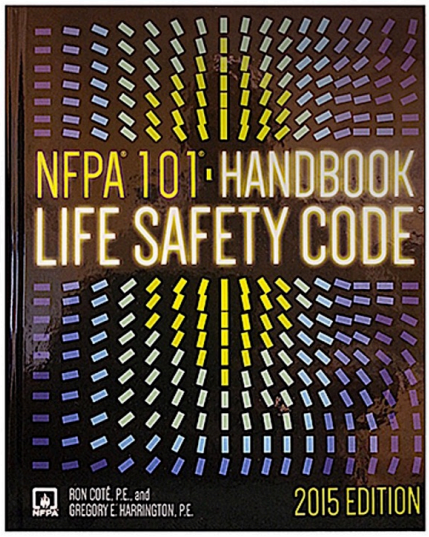
NFPA 70 National Electrical Code

- NFPA 70®, *National Electrical Code®,* NEC®,
- 70E®, *Standard for Electrical Safety in the Workplace®,*
- NFPA 72®, *National Fire Alarm and Signaling Code®,*
- NFPA 101®, *Life Safety Code®,*
- NFPA 5000®, *Building Construction and Safety Code®*
- are registered trademarks of the National Fire Protection Association, Quincy, MA.

- NFPA 70 *National Electrical Code* details methods and materials of electrical installation.
- Electrical engineers utilize NFPA 70 during their electrical systems designs.

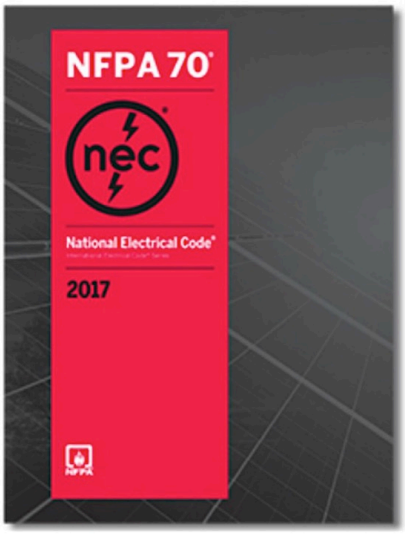


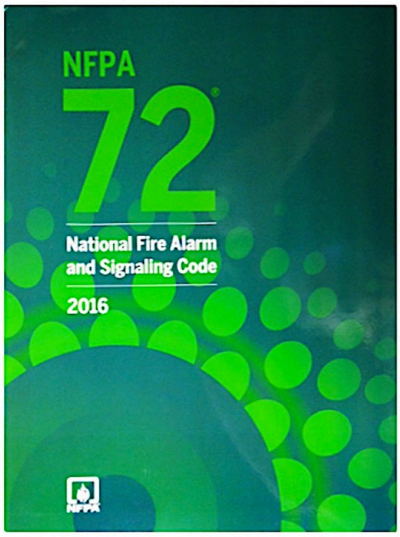


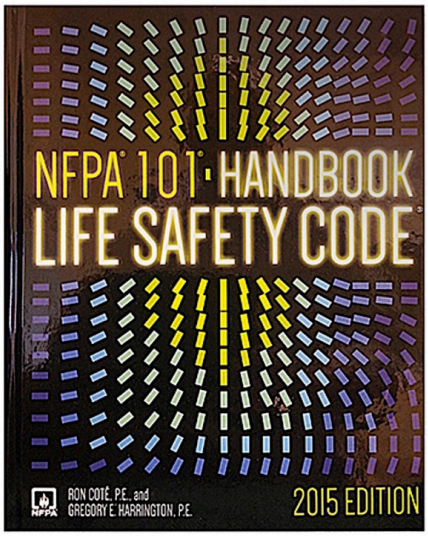


NFPA 72 *National Fire Alarm and Signaling Code*

- describes HOW to apply fire alarm or mass notification systems.
- In year 2010,
- the NFPA 72 *National Fire Alarm Code*" added EVACS and mass notification
- and was renamed "the NFPA 72 *National Fire Alarm and Signaling Code*."

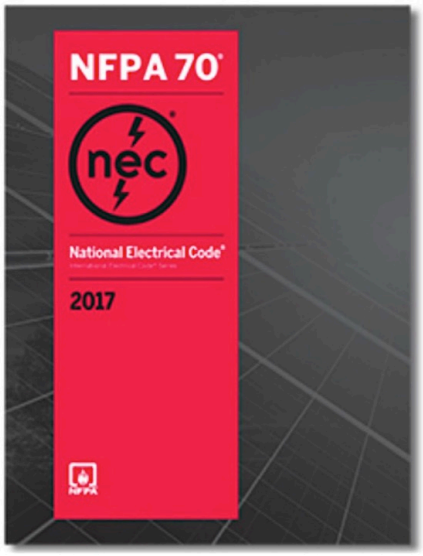


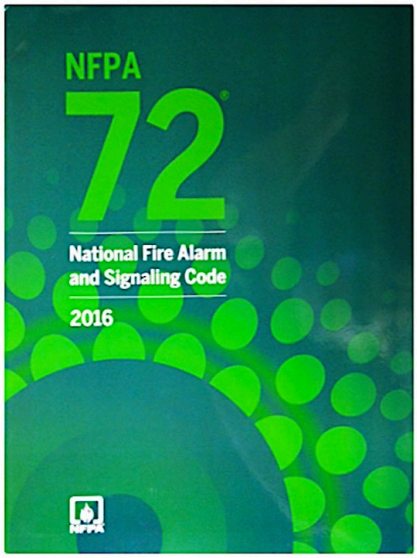


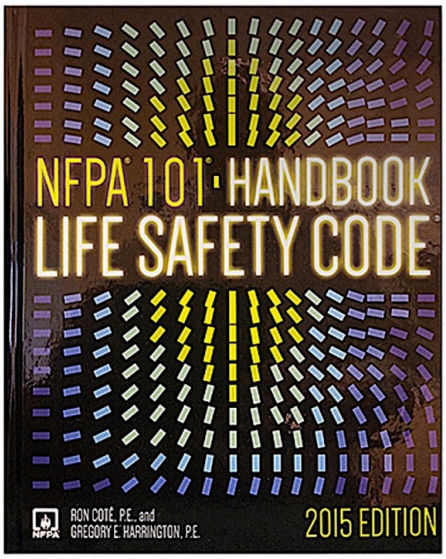


NFPA 101 Life Safety Code

- tells WHICH fire alarm strategy to utilize for a type of occupancy.
- For each type of occupancy, NFPA 101 discusses the applicable
    - fire alarm, mass notification, sprinkler fire protection,
    - egress, emergency lighting,
    - smoke barriers, and special hazard protection.



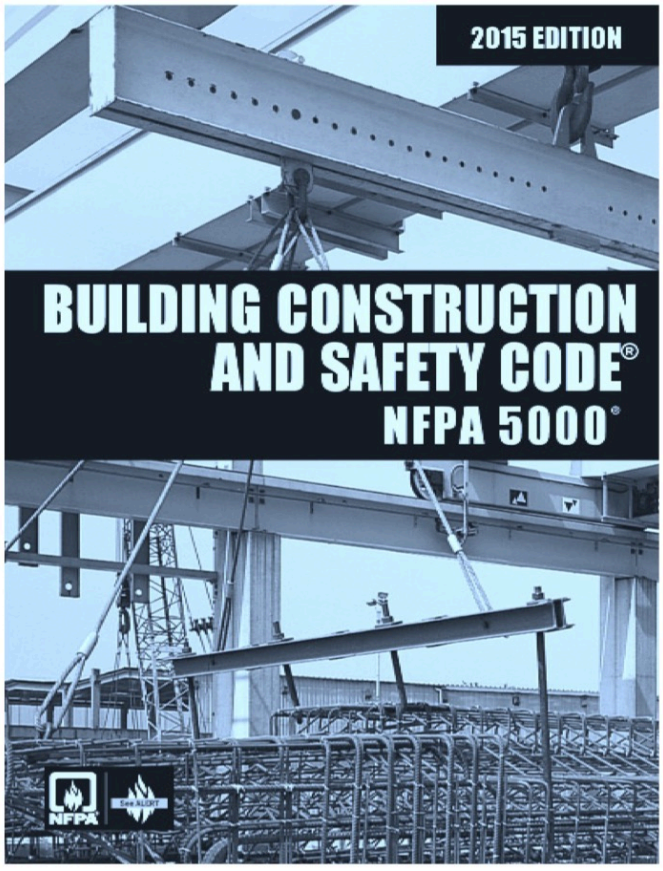




NFPA 5000 BUILDING CONSTRUCTION AND SAFETY CODE

- Goals of NFPA 5000 are safety, health, building usability, and public welfare during normal use and during fire conditions.
- NFPA 5000 Chapter 4 states that the "safety goal" is to reduce the probability of injury or death from fire, structural failure, and building use.
- NFPA 5000-54 shows the inter-relationship of elevators with fire alarm, power, controls, ventilation, and minimum 1 hour fire resistance rating.
- NFPA 5000-55 has a 5 page discussion of "Fire Protection Systems and Equipment" and requires conformance to NFPA 5000-55 and to NFPA 72.
- NFPA 5000 paragraph 3.3.67.10 defines "High-Rise Building" as "a building where the floor of an occupiable story is greater than 75 feet (23 meters) above the lowest level of fire department vehicle access."
- Fire alarm systems have more stringent requirements in a high-rise building.
- NFPA 5000 paragraph 3.3.35 defines "Area of Refuge" for temporary protection from the effects of fire.
- Areas of Refuge having fire resistant intercom systems help firefighters make rescues.

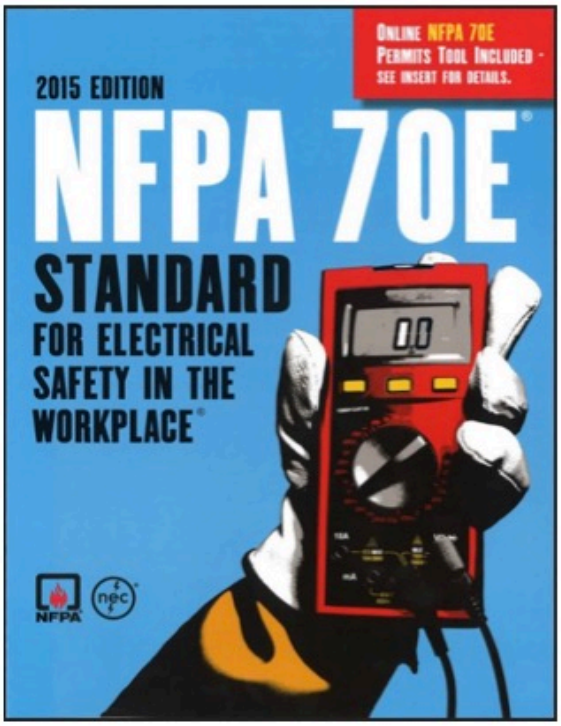
Credit: 2015 NFPA 5000 © 2015 NFPA, reproduced with permission.



NFPA 70B, NFPA 70E, UL 894, and ULC S527

- To increase fire safety, utilize these codes in the workplace.
  - NFPA 70B *Recommended Practice for Electrical Equipment Maintenance*
  - NFPA 70E *Standard for Electrical Safety in the Workplace.*

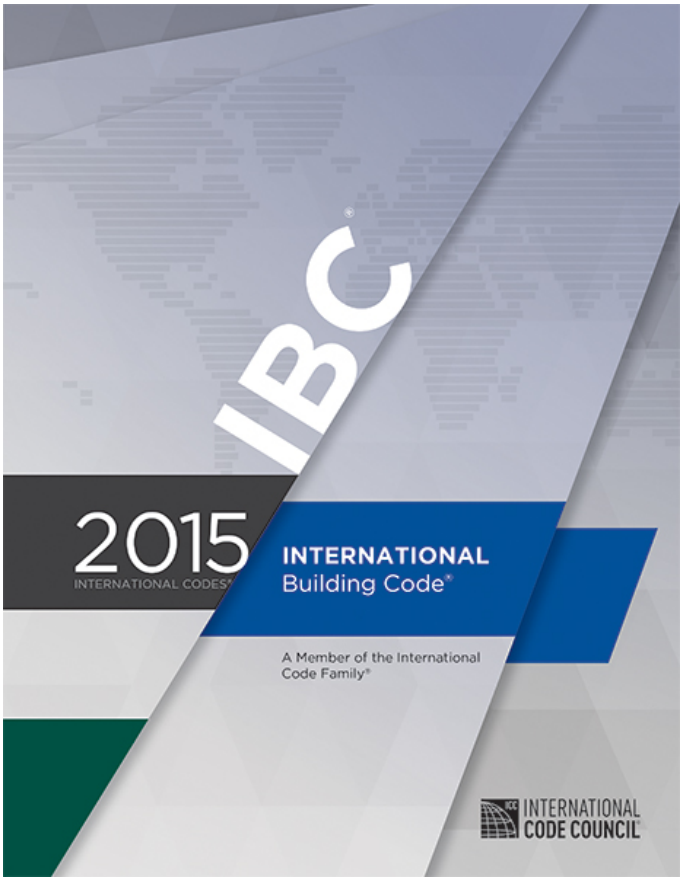
- To increase fire safety, fire alarm products are designed to these standards.
  - NFPA 72,
  - UL 864 *Standard for Control Units and Accessories for Fire Alarm Systems* and
  - ULC S527 (Canadian) *Standard for Control Units for Fire Alarm Systems*.



IBC, International Building Code

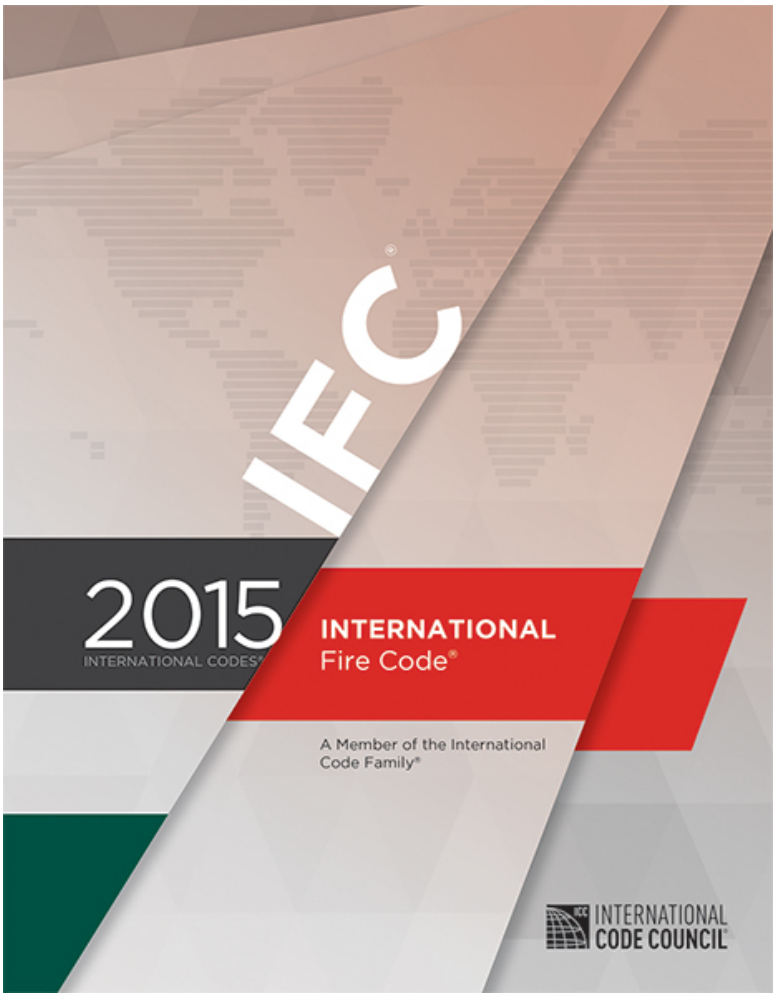
- Many states, counties, or other jurisdictions have adopted the IBC.
- Since the early twentieth century through year 1997, the U.S.A had three code groups.
  - SBCCI "*Southern Building Code Congress International*" in the Southeast.
  - BOCA "*Building Officials Code Administrators International*" on East Coast and some Midwest.
  - ICBO "*International Conference of Building Officials*" on West Coast and some Midwest.

- These three code groups decided to combine efforts.
  - In 1994 these groups formed the ICC International Code Council
  - to develop a code having no regional limitations within the U.S.A.
- The IBC *International Building Code* was first published in 1997.
- ICC discontinued development of the legacy codes year 2000.
- NFPA remained separate from IBC having different purposes.
- However, IBC incorporates some NFPA codes by reference.
- 2015 IBC ®, *International Building Code*®
- 2015 IFC ®, *International Fire Code*®
- are registered trademarks of the National Fire Protection Association, Quincy, MA.



IFC International Fire Code

- IBC addresses building design and construction including fire reduction issues.
- IFC focuses upon some fire alarm applications.



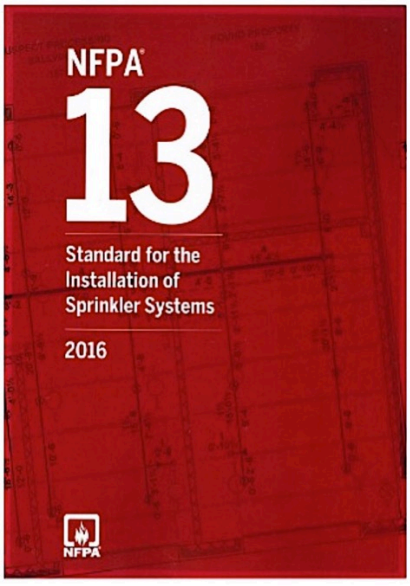
Some IBC References the NFPA

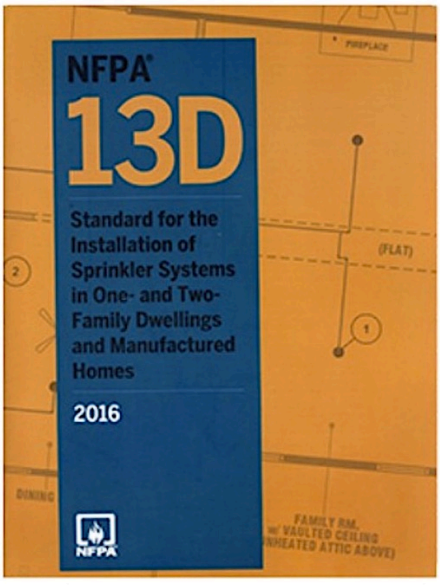
- The IBC references some other codes. If a jurisdiction adopts IBC, it also adopts those referenced codes.

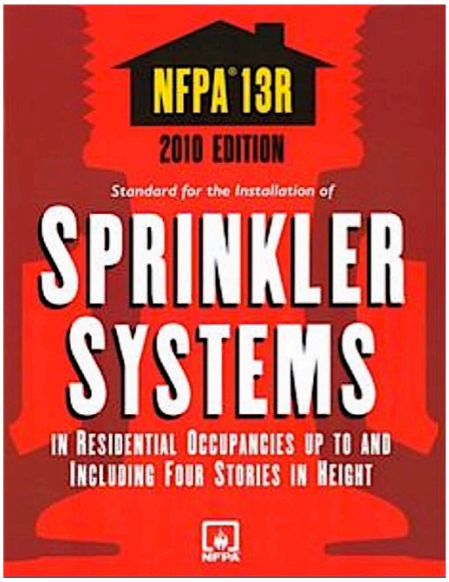
- The IBC references some NFPA codes including these.
    - NFPA 13, NFPA 13D, NFPA 13R regarding sprinkler systems
    - NFPA 58: *Liquefied Petroleum Gas Code*
    - NFPA 72 *National Fire Alarm and Signaling Code*
    - NFPA 70 *National Electrical Code*

- For your own work, look it up in the code. Use this information for a general idea.

There are plenty of details and exceptions and things not covered in this course. One never knows which detail will apply to ones own work.







WHAT DRIVES THE DEVELOPMENT OF FIRE ALARM SYSTEMS?

Expectations

- "The Public" expects better protection and fire prevention.
- Firefighters expect better information for better lifesaving and firefighting.
- As technology develops, people expect more performance as follows:
    - Improve self-diagnostics, dependability, and accuracy.
    - Reduce false alarms while increasing protection.
    - Adopt broadband technology.
    - Deal with cyberthreat.

Four basic technologies

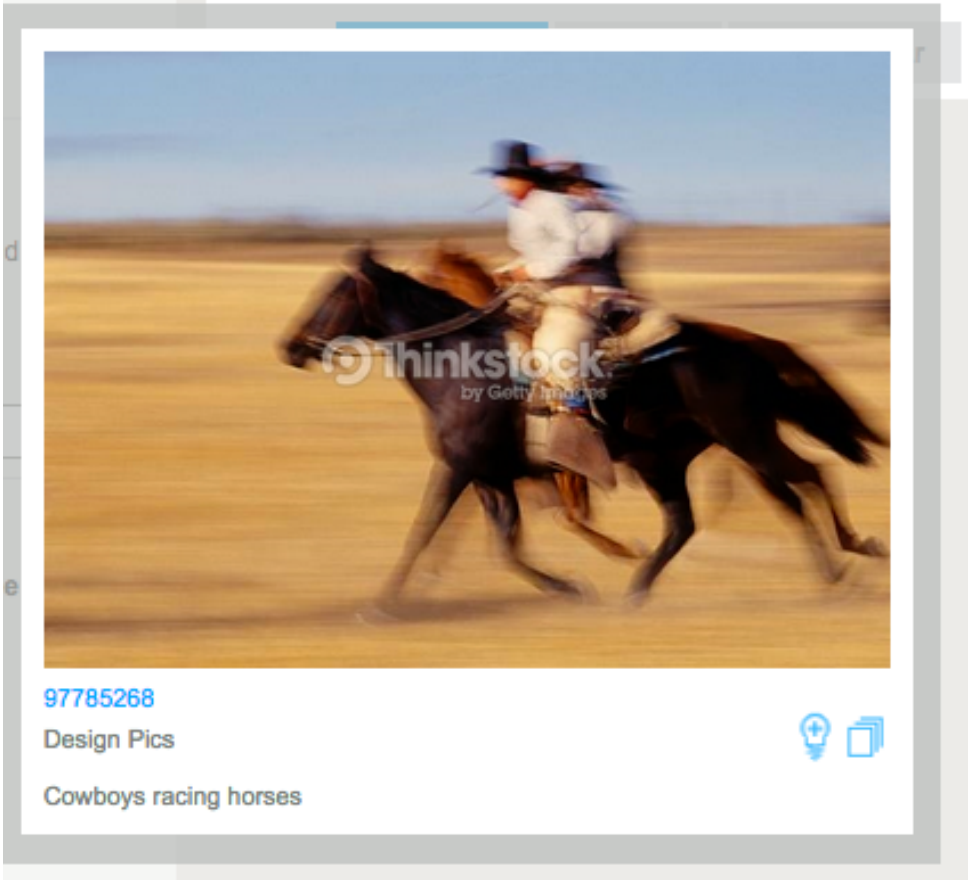
- Each technology remains in service somewhere, and still matters.
  - Coded master box fire alarm systems
  - Relay “Conventional” fire alarm systems
  - Addressable Systems
  - and Integrated Systems.

CODED BOX SYSTEMS

- Coded Boxes answered the firefighter question “Which building has a fire?”
- Other terms are “Master Box” and “Master Coded Box”.

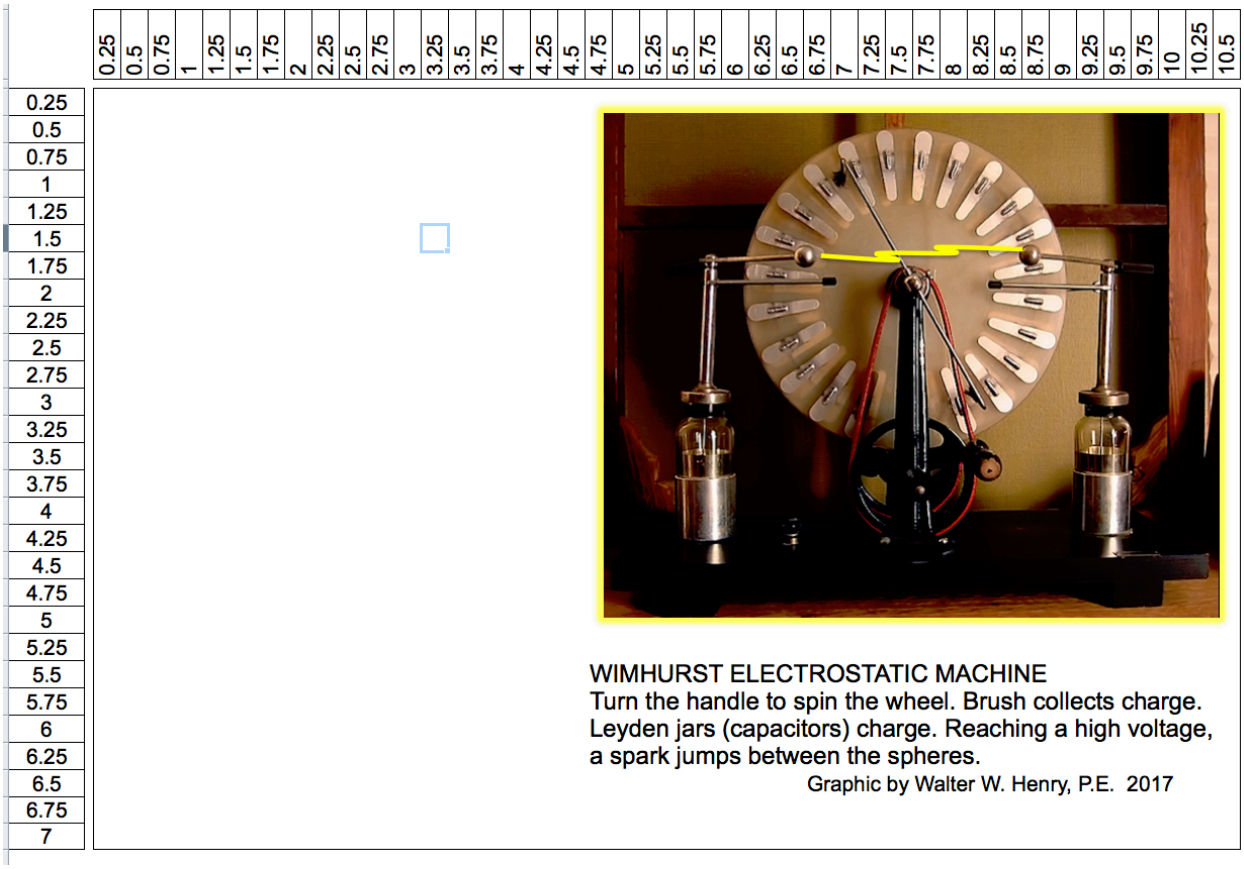
Initial Situation

- Into the 1870’s, it took a lot of time to tell the location of a fire.
- People ran or rode animals to get firefighting help.
- Then the information could be incomplete or inaccurate.
- Therefore COMMUNICATION IS BASIC TO FIRE ALARM.



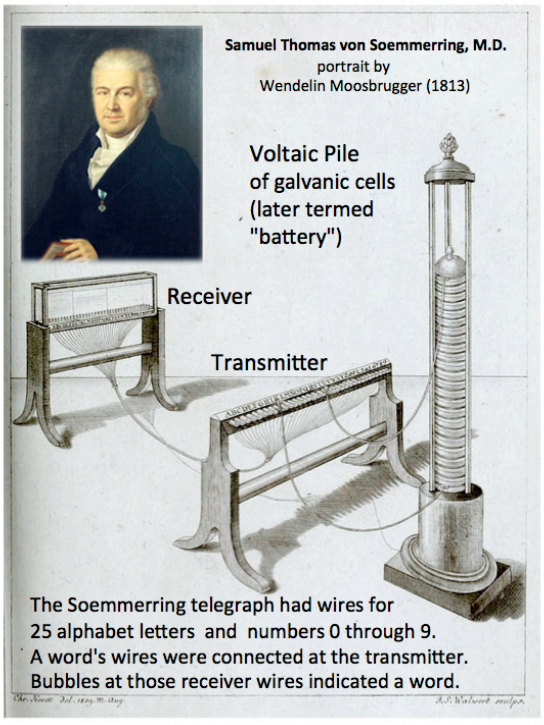
Telegraph Begins

- These are a few credits among many inventors.
- A practical telegraph was necessary before fire alarm systems could exist.
- In the mid-1700's, European telegraphs powered by electrostatic machines were too weak and too intermittent to have much distance or signalling power.
- In 1800, Alessandro Volta assembled a "voltaic pile" which got rid of the power problem.
- Francis Ronalds in 1816 built the first working telegraph. Ronalds used revolving dials marked with the alphabet, and eight miles of wire. The Admiralty decided that the system was unnecessary.
- Baron Schilling von Canstatt in 1832 made a keyboard of 16 keys, receiving galvanometers, and eight wires. Nicholas I of Russia was interested.



Soemmerring Telegraph

- In 1809, Samuel Thomas von Soemmerring, M.D. of Bavaria invented a telegraph using a voltaic pile for plenty of power. Soemmerring used one wire per letter and one wire per numeral. This was an 1804 concept by Spanish scientist Francisco Salva Campillo. Bubbles at connected wires indicated alphabet wires and numbers. Lamps or bells didn't exist.
- Hans Christian Oersted, Johann Schweigger, and other scientists discovered principles toward telegraph development.



Early Telegraph

- It was possibly Harrison Gray Dyar who sent the first American telegraph message in 1826, from the Long Island race track to a newspaper office. His system was opposed for alleged “security reasons”.
    - Batteries powered it. The system’s few wires cut cost and complication.
    - Telegraph poles had insulators made of apothecary jars
    - Receiver used rotating litmus paper where sparks created red dot code, years before Morse code.

In 1833, in Gottingen, Carl Friedrich Gauss and physics professor Wilhelm Weber ran their telegraph wiring over the city roofs.

In 1836, Dr. David Alter of Pennsylvania invented a telegraph.

In 1837, Cooke and Wheatstone co-developed the first commercial electrical telegraph. The inspiration was railway.

Dyar telegraph pole

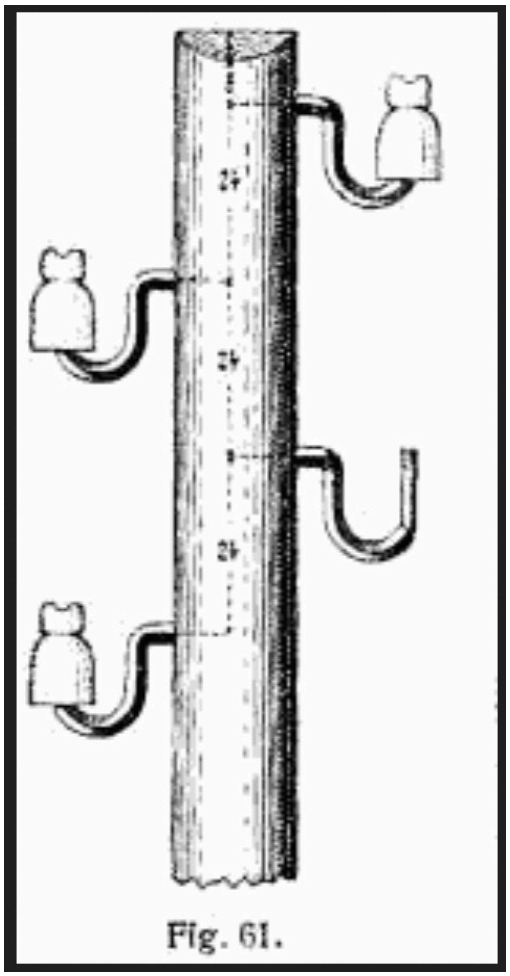
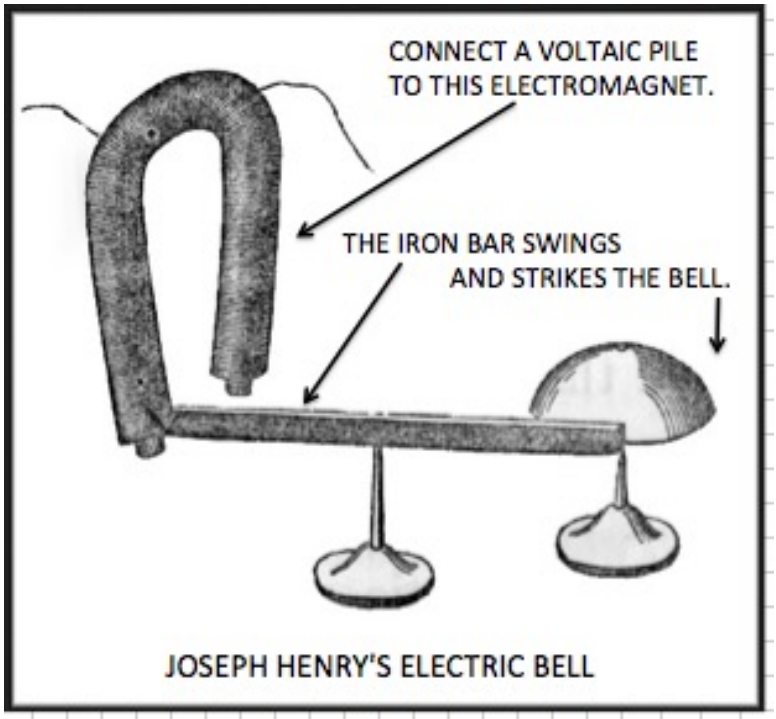


Fig. 61.

More Power: Enter the Electromagnet and Electrical Relay

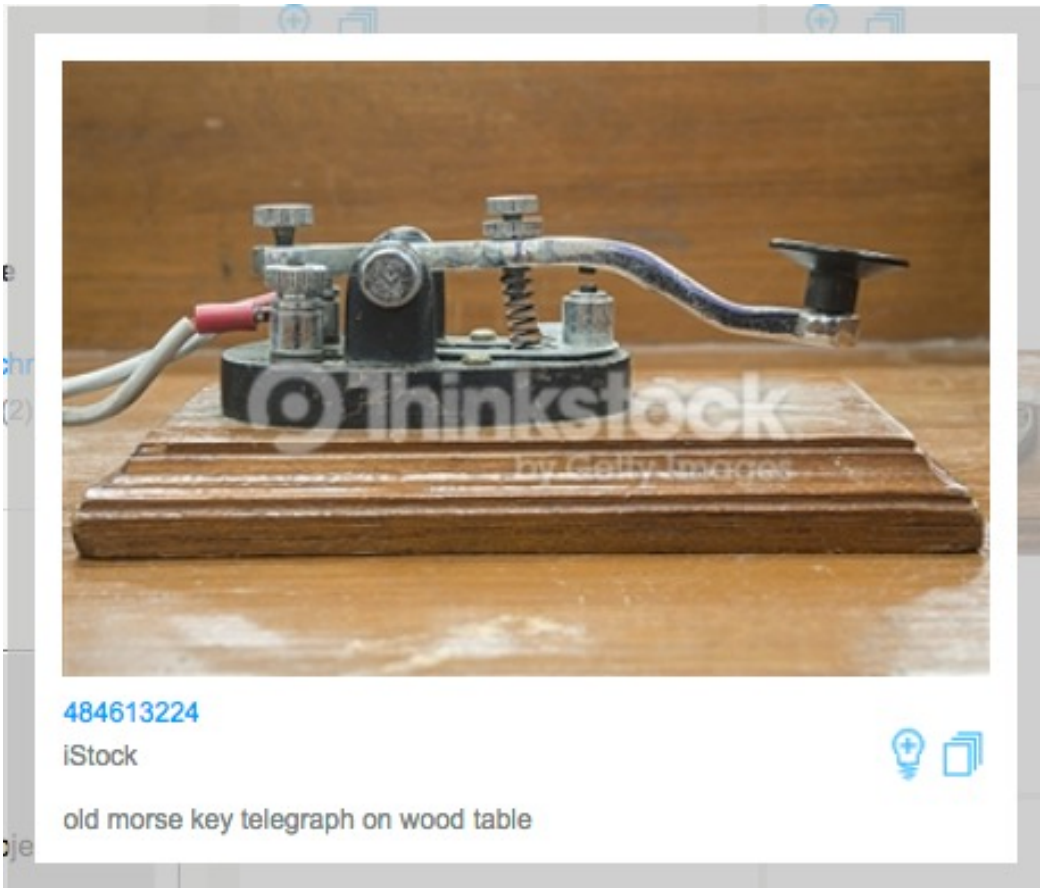
- Europeans and Americans sought “more power” for longer lines and a practical means to indicate the alphabet. Examples are Oersted, Only a few credits are shown here.
- In 1825, William Sturgeon of Great Britain invented a weak electromagnet of one winding.
- Electric Bell and Strong electromagnet: Joseph Henry the scientist, founder of the Smithsonian, freely published and shared his findings. By 1829 Henry demonstrated an electromagnet having 400 turns of wire. A mile of wire was wound around his lab between the battery and the bell. The magnet caused a bar to strike a bell. This was a very early electric bell.
- Electric Relay: In 1835, Edward Davy invented the electrical relay. Henry invented a relay by 1837, and Morse by 1840. Why a relay? **A relay is an electrically operated switch that connects new power.** A signal can lose strength after miles of wire. A relay coil senses that small signal and operates a heavy duty switch that connects a fresh battery to power more miles of wire or a local clicker or bell.

Research and Application: Scientists discovered phenomenon and shared information. Application designers sought commercial uses and made patents. Joseph Henry explained research. “It is in the study of objects considered trivial and unworthy of notice by the casual observer that genius finds the most important and interesting phenomena. . . . .and, surely, in the language of one of the fathers of modern physical science, "nothing can be unworthy of being investigated by man which was thought worthy of being created by GOD." (Smithsonian Annual Report for 1852, p. 15.)



More Control Wanted: the Electrical Relay

- Samuel Morse had consulted with Joseph Henry and other generous scientists for concepts.
    - By 1837, Samuel Morse and Morse's assistant Alfred Vail had independently developed, patented and marketed a recording electric telegraph system. Morse utilized Dyar's concept of code and invented his own signalling alphabet.
    - The manual telegraph key closes the electrical contact to operate the electromagnet at the receiving end. Later telegraphs used fast automatic machines.
    - In 1844 from the U.S. Capitol through 44 miles to Baltimore was sent the message "WHAT HATH GOD WROUGHT?"
    - The Morse/Vail telegraph connected the U.S. east and west coasts by October 1861, bring the Pony Express to an end.



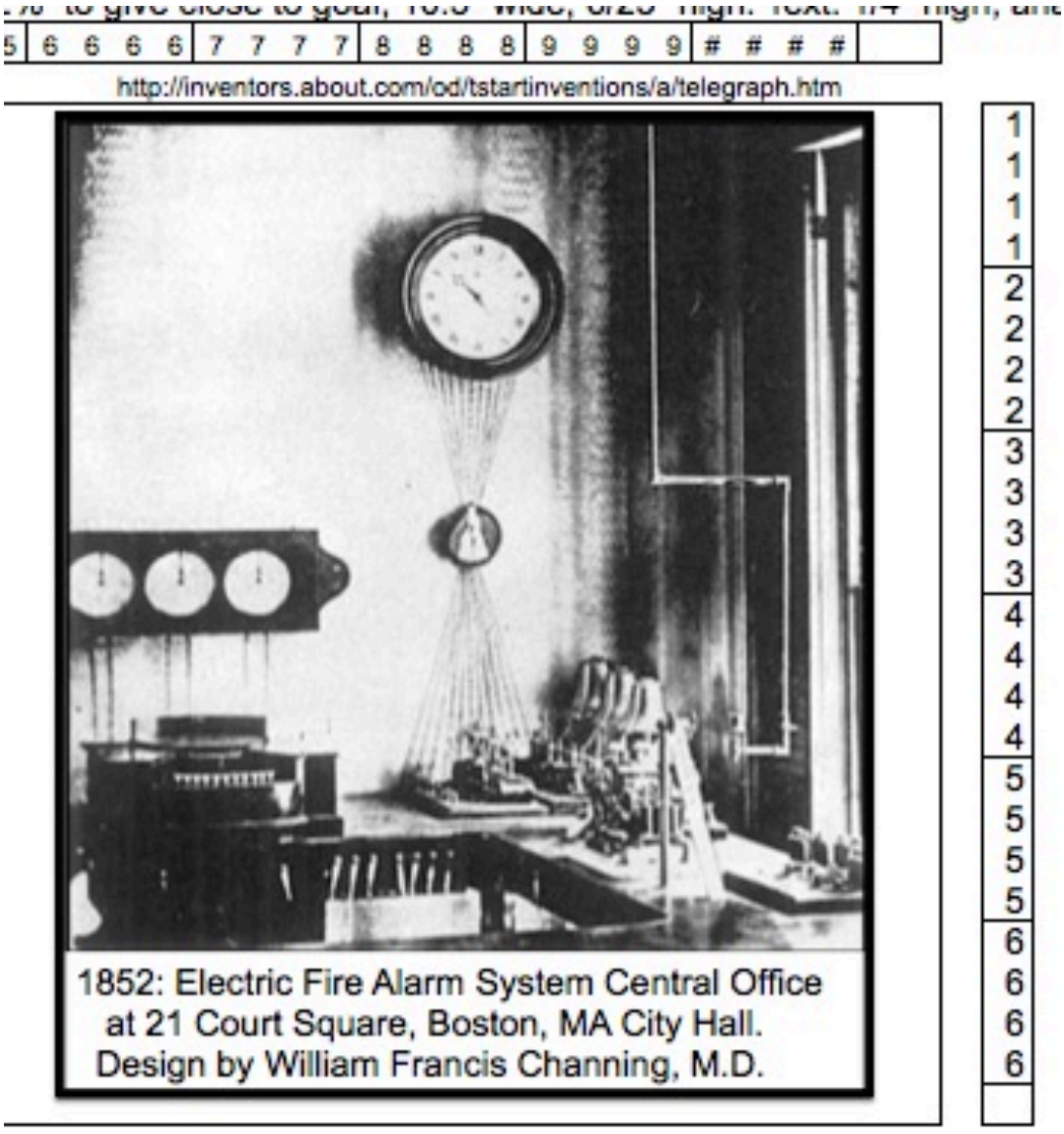
How did Telegraph Inspire the Development of Fire Alarm?

- By 1843 Dr. William F. Channing of Boston and Alexander Baine of England independently thought of telegraph to summon a fire department efficiently.
- In 1845, Dr. Channing published an article in the Boston Daily Advertiser

describing a practical fire alarm telegraph system.

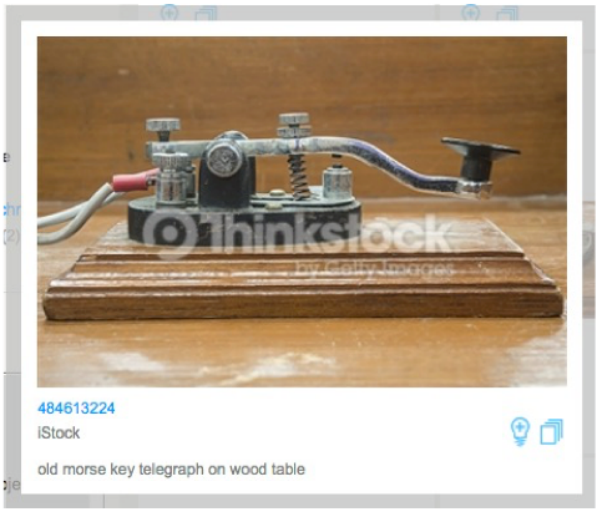
- Dr. Channing devised plans with a telegraph engineer Moses G. Farmer, and convinced the city government to install it.
- By 1852, Boston had installed Channing's Fire Alarm Telegraph.

This was the first of its type in the world.



ACTIVITY #1

Match the term with the equipment picture.



telegraph key Initiating device Annunciating device

Activity:

Let's see if you can identify the three _____.

Drag each term to its corresponding image.

Answer Text Here	Answer Text Here	Answer Text Here
Replace this box with an image.	Replace this box with an image.	Replace this box with an image.

John N. Gamewell

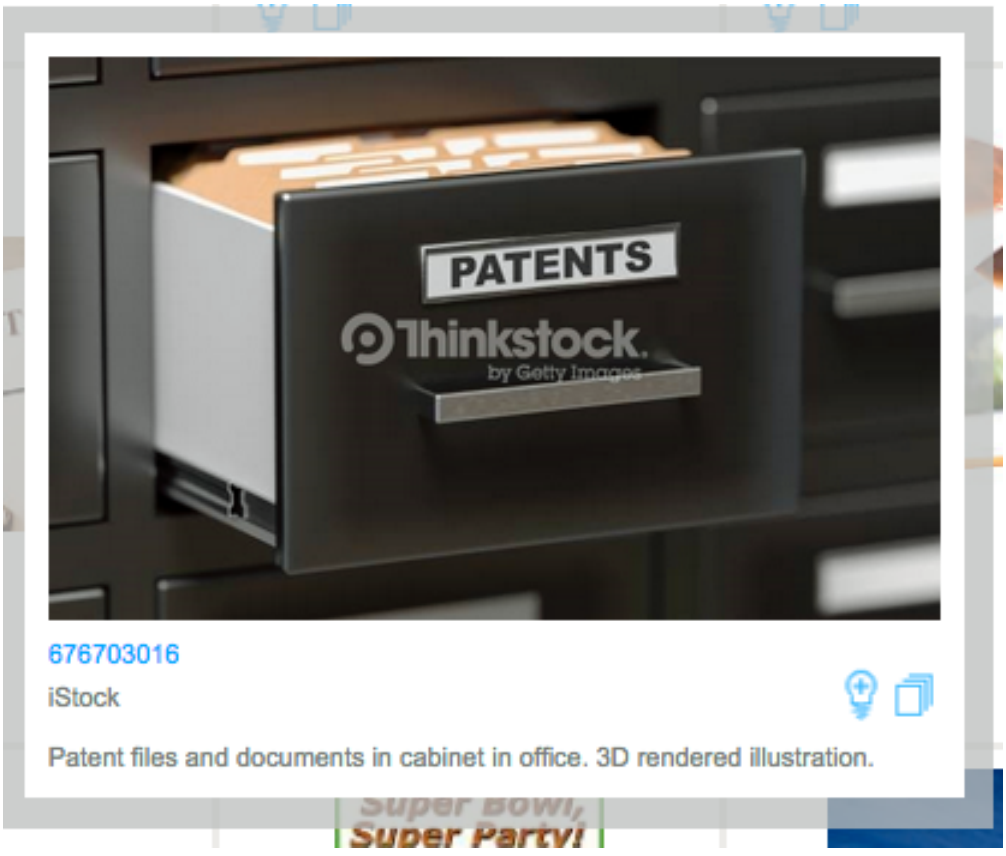
Why was John Gamewell so significant to fire alarm in the United States?

- John Gamewell purchased rights and developed a practical fire alarm system into the entire United States, prolifically and fast.
- The costliest war in American history, above 623,000 casualties, interrupted but did not stop Gamewell and his supporters.

Gamewell's Inspiration and Start

John N. Gamewell of Camden of South Carolina was a postmaster and telegraph agent.

- In 1855, Gamewell attended Dr. Channing's Fire Alarm Telegraph lecture at the Smithsonian Institution.
- There Joseph Henry experimented with solenoids, telegraph and electric bells.
- Gamewell saw the value of Channing & Farmer's Fire Alarm Telegraph system.
- In 1854, Channing and Farmer applied for a patent for the "Electromagnetic Fire Alarm Telegraph for Cities".
- In 1855, John Gamewell purchased the regional rights to construct Channing & Farmer's Fire Alarm Telegraph system.
- In 1859 Gamewell purchased the total rights to Channing & Farmer patents.



Gamewell Survives "The War" and Begins Business

- John Gamewell returned home from Boston to South Carolina during "The War" from 1860 into 1865, the War Between the States.
- Gamewell's patents were confiscated and sold at auction.
- John Kennard of Boston, a Gamewell's employee, took twenty thousand dollars to Washington after The War. Kennard recovered the patents for just eighty dollars, and returned the patents to Gamewell.

- At one point shortly after The War, Gamewell pursued business as "American Fire Alarm Telegraph, John N. Gamewell & Company, proprietor".
- In 1867 Gamewell and Kennard formed a partnership as Kenard and Company in Newton Upper Falls, Massachusetts to manufacture the fire alarm telegraph systems.
- In 1879, Gamewell reorganized as "Gamewell Fire Alarm Telegraph Company" with John N. Gamewell as proprietor. The "fist holding lightning bolts" became the registered trademark.

Credit: photo by Walter W. Henry, P.E., 2008

GAMEWELL LOGO from Box.jpg

How did Gamewell Coded Box systems become so widely known?

- Early Gamewell installations in the United States included
  - Philalphia, PA in 1855, St. Louis, MO in 1856,
  - New Orleans, LA in 1860, Baltimore, MD in 1860,
  - New York City, NY in 1869, St. Paul, MN in 1873,
  - and Minneapolis, MN in 1874.
- By 1886, Gamewell systems were installed in 250 cities across America,
- and in 500 cities by 1890.
- In 1910, Gamewell still held 95% market share for coded master box systems.

Credit: Thinkstock 484100304

Multiple Manufacturers Made Fire Alarm Appliances.

Here are some examples.

- Edwards:
  - Robert Edwards patented his electric bell in 1881,
  - patented an annunciator in 1882,
  - and by 1886 made burglar alarms.
  - By 1896 Edwards Signaling focused on signaling, communications and protection equipment.
- Faraday was founded in 1875 in Brooklyn, New York and by 1900 was producing notification appliances such as bells, horns and buzzers.

Credit: Photo is used by courtesy of eBay seller Darek_Smok, 2017

EDWARDS 1872 FIREHOUSE BELL, Darek_smok, 2017.jpg

Some Appliance Manufacturers in Early 1900's

- Benjamin Electric began making bells in the 1920's.
- Federal Signal began making electric sirens about 1915.
- About 1920, Autocall began making
    - a coded box fire alarm system
    - and an automatic punch recorder for fire alarm
- In 1933, Autocall purchased Howe. Autocall-Howe made fire alarm systems for large institutions and industry.
- The image is a bell style used from about the 1930's into the present.

Credit: Photo is used by courtesy of eBay seller Lonemalt, 2017

Autocall bell, Lonemalt, 2017.jpg

How did People Use the Coded Box System?

- The Coded Box System answered “Which building or town area is on fire?”
- “LOCATION” is the primary piece of information which a fire alarm system of any type should tell a firefighter.
- A person would run out of the building to the closest fire alarm box.
- If a fire alarm pull station was located in a specific building, a “Key Holder” person
    - would open the pull station cover
    - then pull down the lever.

Credit: photo by Walter W. Henry, P.E., 2006

IMG_1869 indoor antique pull station.JPG

Why Is a Coded Message Valuable?

- A coded message to the fire station bypassed
  - panic,
  - accents of speech,
  - an inability to express location,
  - telephone and telegraph problems,
  - or an inability to travel to the fire station.

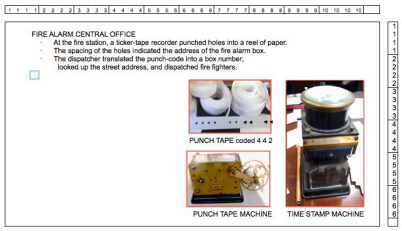
Credit: Thinkstock 468900480

Fire Alarm Central Office:

- At the fire station, a ticker-tape recorder punched holes into a reel of paper.
- Spacing of holes indicated the box address .
- The dispatcher translated the punch-code into a box number, looked up the address, and dispatched fire fighters.

Credit: Photos are used by permission of Gregory Lynskey, Webster, Mass.,2016

Punch tape & machine & time stamp, Gregory Lynskey, 2016.jpg



PUNCH TAPE coded 4 4 2

PUNCH TAPE MACHINE

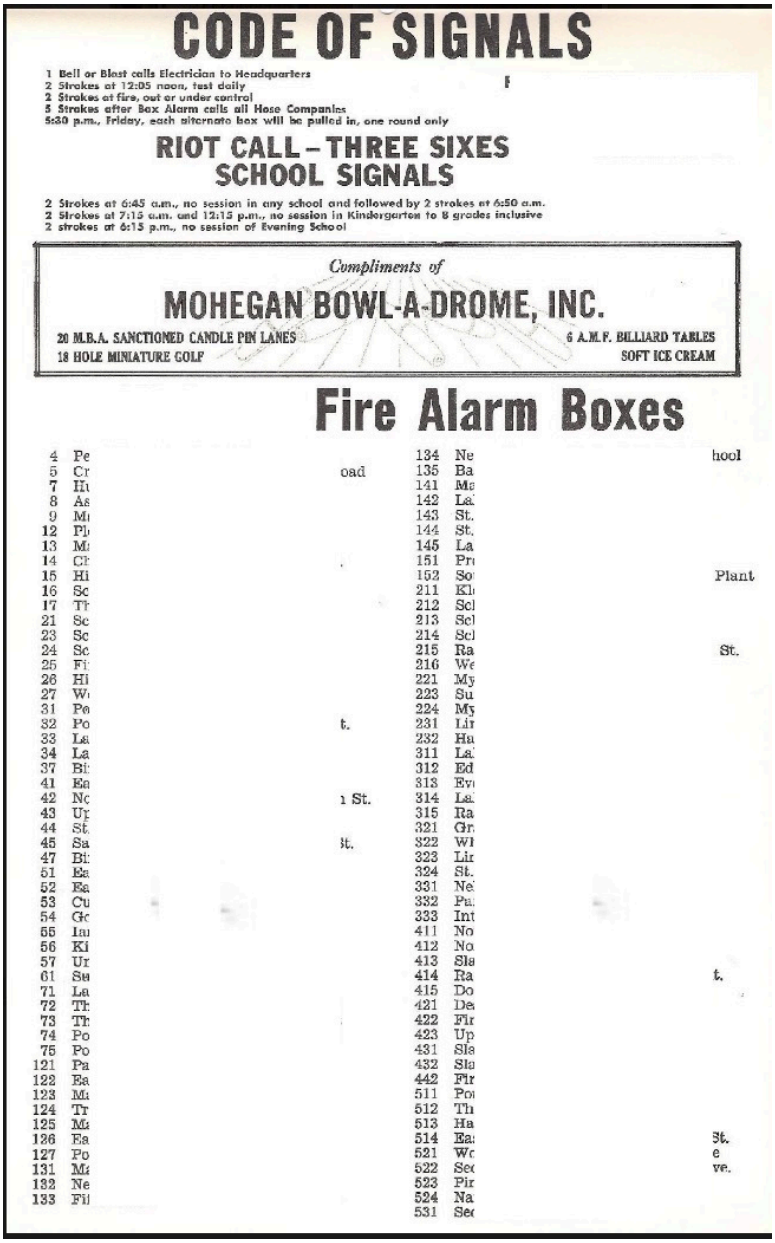
TIME STAMP MACHINE

How were Coded Wheel Systems Utilized?

- A Fire Department in Massachusetts shared it's coded box experience.
- Bells or horns were located
  - in fire stations, churches, commercial buildings,
  - factories, nursing homes, and schools.
- If a box was operated, the box code told the box location to the fire company.

Credit: Photo is used by permission of Gregory Lynskey, Webster, Mass.,2016

Webster MA box 1972 Code of Signals, Gregory Lynskey, 2016.jpg



CODE OF SIGNALS

1 Bell or Blast calls Electrician to Headquarters
2 Strokes at 12:05 noon, test daily
2 Strokes at fire, out or under control
5 Strokes after Box Alarm calls all Hose Companies
5:30 p.m., Friday, each alternate box will be pulled in, one round only

RIOT CALL – THREE SIXES
SCHOOL SIGNALS

2 Strokes at 6:45 a.m., no session in any school and followed by 2 strokes at 6:50 a.m.
2 Strokes at 7:15 a.m. and 12:15 p.m., no session in Kindergarten to 8 grades inclusive
2 strokes at 6:15 p.m., no session of Evening School

Fire Alarm Boxes

4	Pe			134	Ne		hool
5	Cr		oad	135	Ba		
7	Hu			141	Ma		
8	As			142	La		
9	Mi			143	St.		
12	Pl			144	St.		
13	Ma			145	La		
14	Ch			151	Pr		
15	Hi			152	So		Plant
16	Sc			211	Kl		
17	Th			212	Sch		
21	Sc			213	Sch		
23	Sc			214	Sch		
24	Sc			215	Ra		St.
25	Fi			216	We		
26	Hi			221	My		
27	Wi			223	Su		
31	Pe			224	My		
32	Po		t.	231	Lit		
33	La			232	Ha		
34	La			311	La		
37	Bi			312	Ed		
41	Ea			313	Ev		
42	No		1 St.	314	La		
43	Up			315	Ra		
44	St			321	Gr		
45	Sa		St.	322	Wi		
47	Bi			323	Lit		
51	Ea			324	St.		
52	Ea			331	Ne		
53	Cu			332	Pu		
54	Gr			333	Int		
55	Ind			411	No		
56	Ki			412	No		
57	Ur			413	Sla		
61	Sa			414	Ra		t.
71	La			415	Do		
72	Th			421	De		
73	Th			422	Fir		
74	Po			423	Up		
75	Po			431	Sla		
121	Pa			432	Sla		
122	Ea			442	Fir		
123	Ma			511	Po		
124	Tr			512	Th		
125	Ma			513	Ha		
126	Ea			514	Ea		St.
127	Po			521	Wo		e
131	Ma			522	Sec		ve.
132	Ne			523	Pir		
133	Fi			524	Na		
				531	Sec		

Central Station

Central station transmitter could issue signals for various purposes. The respective code wheel was installed.

- For Fire Alarm,
  - Two strokes indicated “fire out” or “fire under control”.
  - Five strokes after a box alarm called all Hose Companies.
- For Maintenance,
  - One bell or blast called the system repair electrician to Headquarters.
  - Two strokes at 12:05PM was a daily system test.
- For other Life Safety purposes,
  - Three sets of six was a RIOT CALL.
  - Two strokes at an appointed time indicated school session cancellation.

Credit: Photo is used by permission of Gregory Lynskey, Webster, Mass.,2016

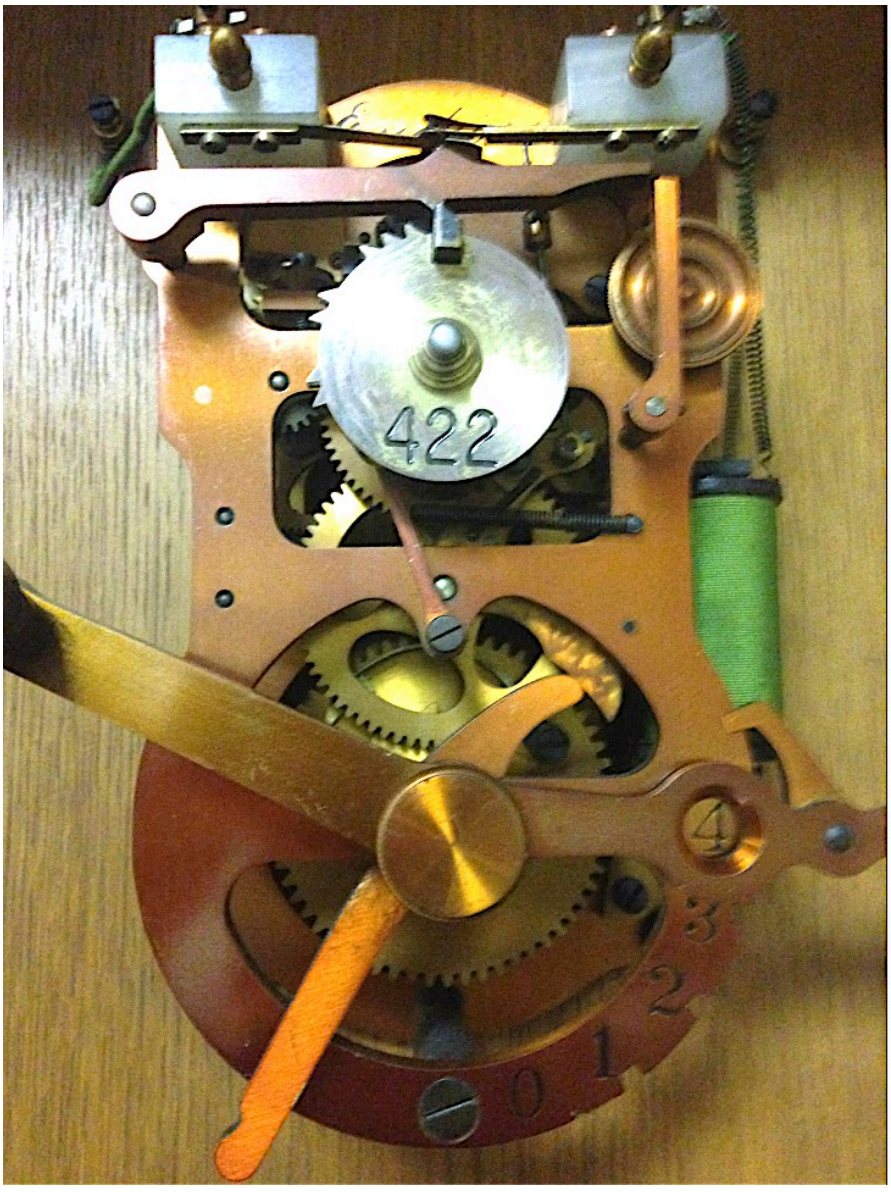
Webster MA alarm transmitter with coded wheels, Gregory Lynskey, 2016.jpg

Code Wheel Function

- The spring is hand wound and will unwind about 5 or 6 turns.
- The code wheel's lugs push the arm in the sequence of lug positions.
- The arm pushes the contacts strip.
- The contacts strip touches the wiring terminals.
- The wiring terminals telegraph current in the same sequence as the lugs.

Credit: Photo is used by permission of Gregory Lynskey, Webster, Mass.,2016

Webster MA coded wheel closeup, Gregory Lynskey, 2016.jpg



What Principles did the Coded Box System Establish?

- A Coded Box defined which building or city area had an alarm.
- The coded box system communicated multiple life safety events.
- The coded wheel “addressable” system indicated a specific address.
- Communication was quick.
- The time of alarm was definitely recorded and known.
- Frequent testing was established as necessary and important.
- Red and white became common fire alarm colors.

Credit: Photo is used by permission of Gregory Lynskey, Webster, Mass.,2016

Gamewell time stamp, Gregory Lynskey,2016.jpg

Coded Wheel Competitors

- In 1928, Fred Harrington began his Coded Municipal Master Box system.
- Autocall worked with telegraph and fire alarm.
- Later, Edwards and Simplex minaturized pull stations for wall mounting inside buildings.

Credit: Photo is used by permission of eBay seller Fly Catcher2002, 2017.

HARRINGTON Box courtesy of eBay seller FlyCatcher2002, 2017.jpg

Master Box Systems Persisted

- Some Owners steadfastly utilized Master Box systems for many years.
- In the 1970's, Harrington Signal introduced their electronic Multiplex Base Loop Reporting System.
- About 1976, this Engineer surveyed the status of a base fire alarm system.
    - The Gamewell coded wheel system remained from the1940's.
    - A box and post was located outside each building.
    - The fire station housed a punched tape recorder.

Credit: Photo is used by permission of Gregory Lynskey, Webster, Mass.,2016

Webster MA pedestal mounted street box.jpg

Example of a Master Box Phase-out

- One town's system
  - began in 1893,
  - grew to over 100 boxes,
  - then reduced after the 1960's
  - and was out of service by 2014.
- Replacement systems were
  - Electronic fire alarm systems in buildings,
  - Firefighter's radio,
  - 911,
  - cell phones,
  - and gradually, Local Area Networks.

Credit: Thinkstock 485815238

Watch a Gamewell Master Box Pull Station

This video demonstrates a Gamewell Master Box in operation. Text panels in the video explain the operation.

Credit: Video by Walter W. Henry, P.E., 2008

GAMEWELL Pull Station, 960x540 .m4v

AUTOMATIC DETECTORS DROVE DEVELOPMENT

People wanted automatic fire detection.

Automatic detectors required more "system" to operate them and utilize their possibilities.

- In 1863, a pneumatic air pressure heat detector was invented in the United States.
- In 1870 the first commercial heat detector was introduced.
- An electronic heat detector was invented in 1890.
- During the 1930's, early smoke detection technologies included projected beam, photoelectric, radioactive ionization, and electrometer ionization chamber. Applications were largely military.
- In the 1940's, Cerberus invented a vacuum tube ionization smoke detector technology utilized for years.
- During the 1950's, there was dramatic expansion of research into better fire protection systems after a tragedy at Our Lady of Angels school.

This is one example that tragedies have driven the development of codes in electrical, fire protection, and other disciplines.

Credit: RedVector layout of Walter W. Henry, P.E. information, 2015

ENTITLE this slide on slide "Automatic Detectors Invention"

Examples of Fires

A School Building Fire in a Small Town

In 1957, this Author began second grade at a county school. The grammar school building was an aged brick building with tall outside windows and transom windows over doors to the hallway. A potbelly stove was located in each classroom. It was an experience back in time.

A few days before Christmas of 1957, word was received that the old building had burned. No one was there so no one was hurt. Grammar school students were moved into the concrete and steel high school building while a new grammar school building was built.

Credit: Thinkstock 544822816

A Large School's Fire

The next year, December 1, 1958, "Our Lady of the Angels" school in Chicago was in session. The building was an aged wooden building with multiple floors. A fire caused many casualties. This event propelled changes in code and motivated some school systems to make changes. These are some examples of changes.

- Provide automatic detectors.
- Install sprinkler systems.
- Provide pull stations and make them accessible to everyone.
- Make fire alarm panels automatically notify the fire station.
- Entries, halls, stairs and doors shall have 2 hour fire ratings.
- Provide door hardware of the emergency exit type.
- Structures and finishes shall be less-flammable.
- Have plenty of fire extinguishers, and make them accessible.

Credit: Thinkstock 504286586

Early Ionization Smoke Detectors

- During the 1940's, Cerberus increased ionization detector efficiency using radio-active vaccum tubes. These were also expensive to purchase and maintain.
- These detectors were for military, industrial, or special applications.
- These detectors were NOT for schools or homes. That's why some buildings with famous fires had no smoke detectors.
- In the1960's, Pyrotronics made their version named Pyr-A-Larm.
- These detectors used 80 microcuries of Americium-241, compared to 1 microcurie in modern ionization detectors.

If you have such detectors, here is some modern advice.

- Do not discard smoke detectors of 5 μCi Americium-241 or higher in the municipal waste stream.
- Never disassemble or take apart ionization smoke detectors!
- Do not store over 400 old radioactive detectors together.
- Inquire at www.CerberusFireDetection.com for recycle instructions.

Image is used by permission of eBay seller Magmish, 2017.

Pyrotronics detector image, courtesy of Magmish.jpg

How Did 1960's Solid State Technology Spread Smoke Detectors?

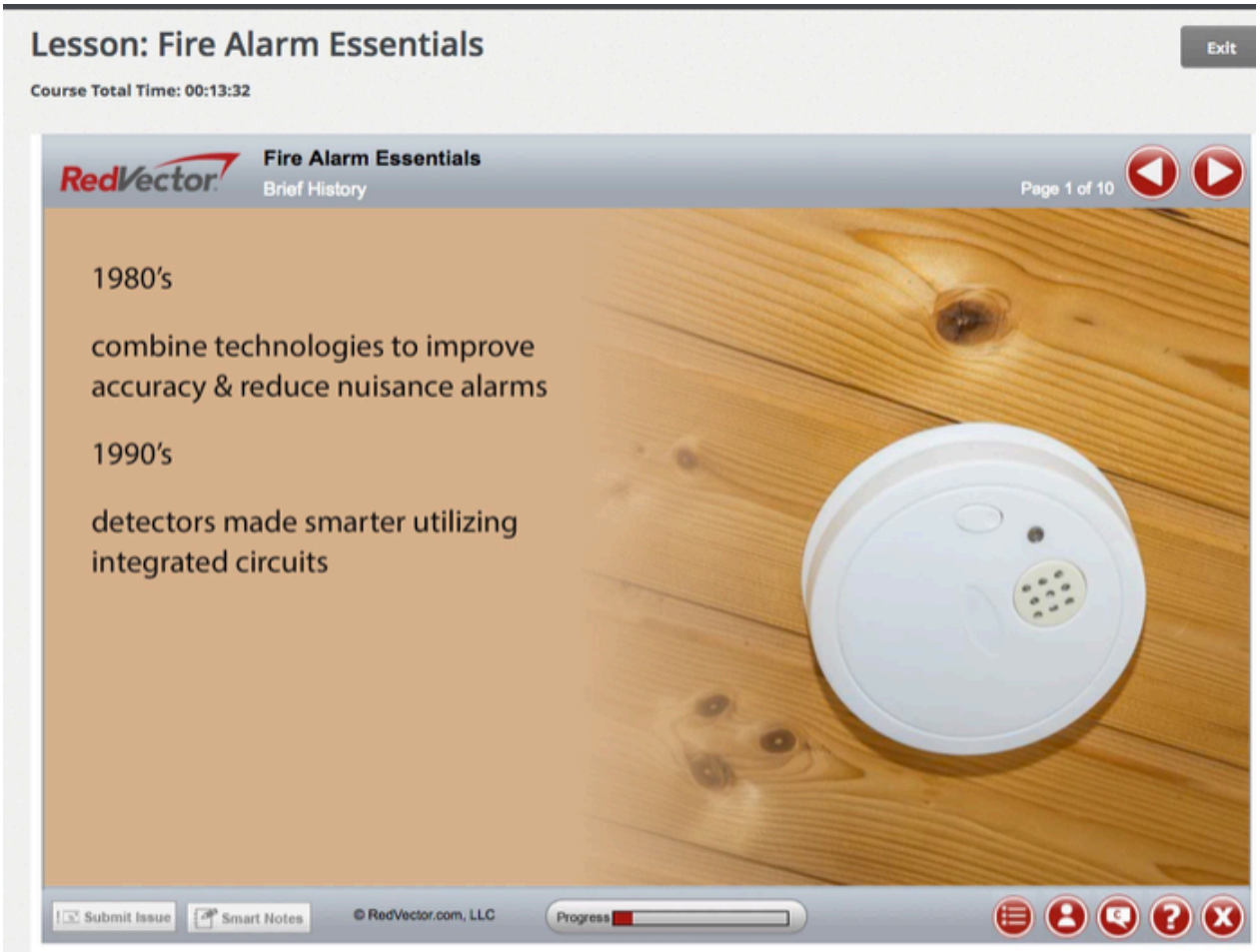
- In the1960's, Japanese introduced completely transistorized smoke detectors.
- Transistorized detectors were relatively low cost and low maintenance.
- Japanese passed the first laws requiring smoke detection in some buildings.
- By the 1970's, automatic detector became common practice.
- The 1970's saw the invention of solid state
    - carbon monoxide detectors,
    - air sampling smoke detectors,
    - ultraviolet radiation flame detectors and
    - Battery operated home smoke detectors.

Credit: Thinkstock 144346577

Automatic Detectors Utilize Integrated Circuits

- In the 1980's, detectors combined technologies to improve accuracy and reduce nuisance alarms.
- During the 1990's, detectors were made "smarter" by utilizing integrated circuits.
- Technology kept increasing accuracy and self-test capabilities.

Credit: Thinkstock 476884821



By the 1960's, disasters and better technology raised expectations.
Why not have protection inside the building, not just at the street?
Where is some equipment to take advantage of the new automatic detectors plus pull stations?
So we come to the next step in system development:

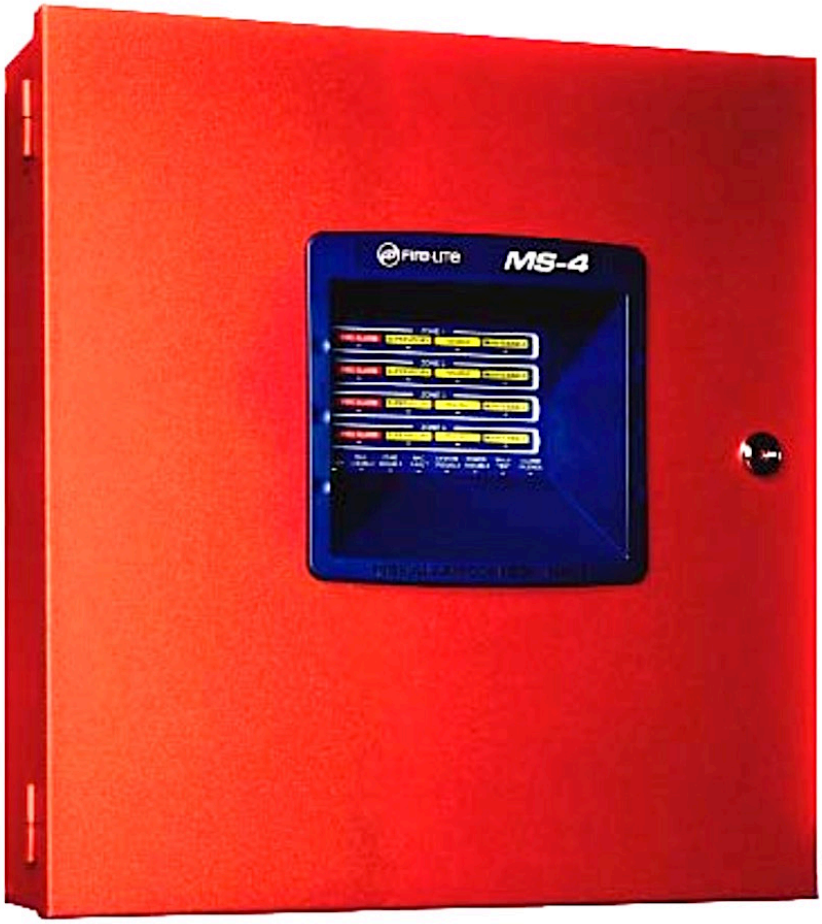
THE ZONED RELAY FIRE ALARM SYSTEM

A Relay Fire Alarm system added these answers.

- Relay "Conventional" "Zoned" fire alarm systems answered the firefighter question "Which AREA of the building has a fire?"
- Did a pull station, automatic detector, or sprinkler system send the alarm?
- Now each building contained so many devices, power and logic that each building required it's own fire alarm panel and "More Power".

Credit: Image is used with permission of Honeywell. Image "MS-4(E) Fire Alarm Control Panel is found in FIre-LITe Alarms by Honeywell, publication DF – 52266-B2.

FIRELITE ALARMS MS-4(E) Fire Alarm Control Panel.jpg



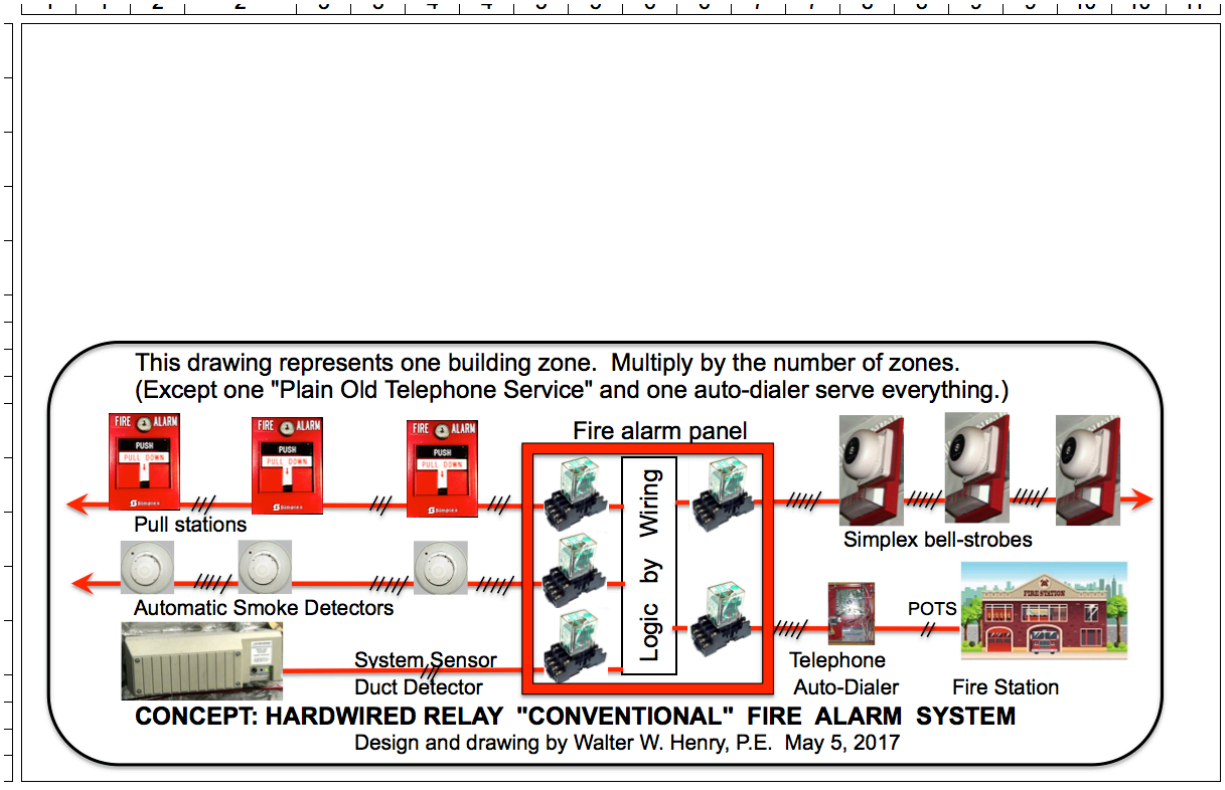
MS4.jpg

Why Have all the Names for the Relay Fire Alarm System?

- During the 1960's and 70's, it was called a Fire Alarm Panel or Zoned Fire Alarm Panel.
- During the 1980's, the term Conventional Panel, Zoned Panel or Relay Panel distinguished it from the newer Addressable Panel.
- About the 1980's, in the Conventional Panels, manufacturers replaced electromechanical relays with solid state transistorized relays. Solid state saved building space and cost, and enhanced some features.

Credits:
Simplex pull station is used by permission of eBay seller CardBoardAttics, 2017.
Allen Bradley relay is used by permission of eBay seller DockGuys, 2017.
Fire station and smoke detector are from Thinkstock.
Graphic, bell-strobe, auto-dialer, & duct detector are by Walter W. Henry, P.E., 2017.

CONCEPT>HARDWIRED RELAY "CONVENTIONAL" FA SYSTEM.jpg



System Voltage

- The earlier Relay Panel systems operated at “line voltage” of 120 volts.
- In the 1970’s, Simplex introduced 24 volt systems to enhance safety.
- This Simplex annunciator has a 120 volt bell and a strobe light.

Credit: photo by Walter W. Henry, P.E., 2008

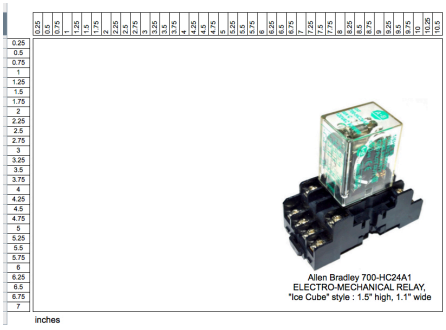
Simplex bell & strobe IMG_4680r50.jpg

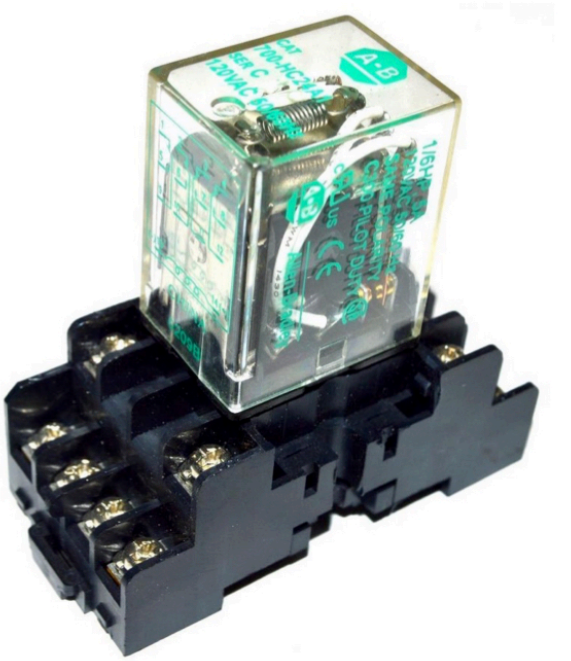
Relays

- The picture shows “electromechanical” relays having electrical coils and mechanically pulled contacts.
    - Electro-mechanical relays are quick, long-lived, resistant to mechanical damage, and
    - resistant to Electro-Magnetic Pulses such as lightning, powerline switching, or other EMP sources.
- Electronic relays utilize solid state switches to accomplish the same function.
- Relay contacts have two conditions: Open and Closed. So the contacts perform digital logic.
- Example: IF the pull station operates, THEN ring bells AND notify the fire department.
- The pictured FIRE.LITE Alarms has solid state relays with output screws for TROUBLE, ALARM, and SUPERVISORY.

Credit: Image is used by permission of eBay seller DockGuys, 2017.

Allen Bradley relay, 200% size.jpg





Allen Bradley 700-HC24A1
ELECTRO-MECHANICAL RELAY,
"Ice Cube" style : 1.5" high, 1.1" wide

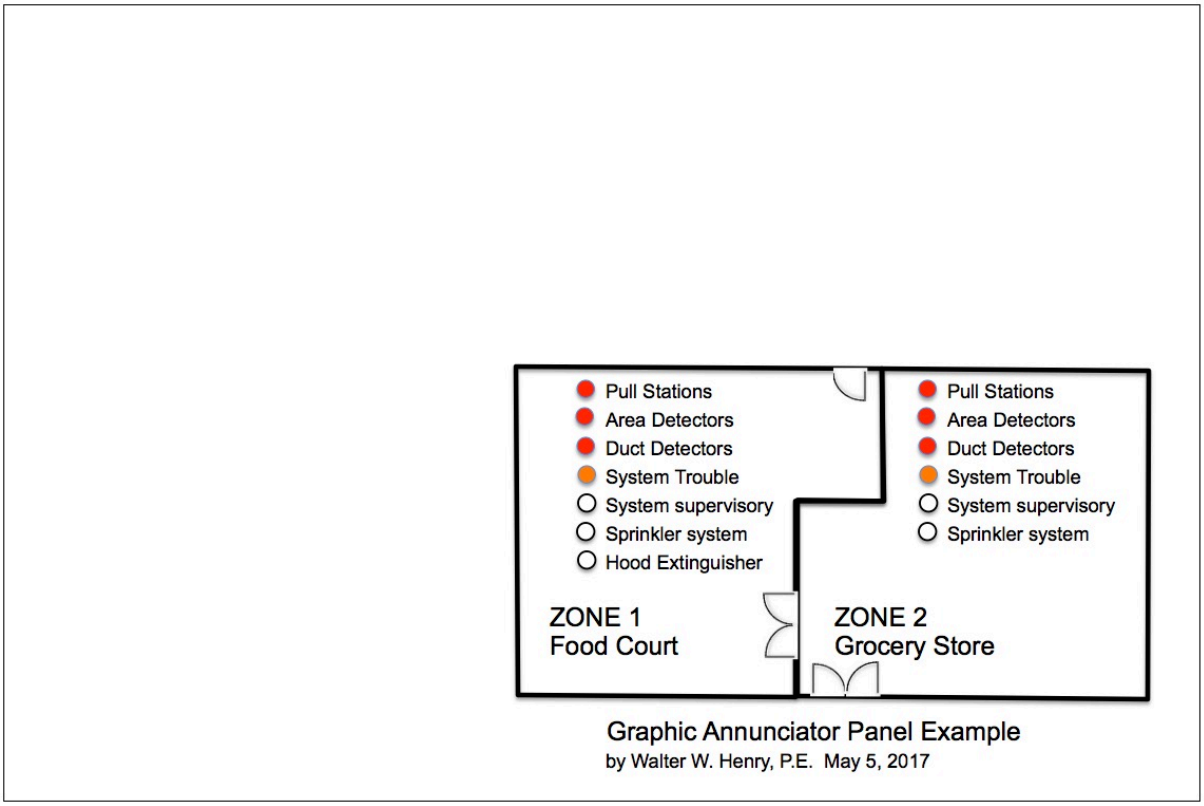
Why have Fire Alarm "Zones" in a Building?

- A "Zone" is a portion of the building area.
- Zones help the firefighters know where to focus.
- An Annunciator Panel lists zones or outlines zones on a floor plan.
- A lamp illuminates to indicate if that type of device initiated the signal.

Credit: Drawing by Walter W. Henry, P.E., 2017

Layout person, show both items, as I show them here.

GRAPHIC ANNUNCIATOR PANEL EXAMPLE.JPG



Why was a Relay Fire Alarm Panel and Wiring so Bulky?

These next pages list some typical equipments that connect to a fire alarm panel, whether Conventional, Addressable, or Integrated. These equipments won't be repeated in those sections.

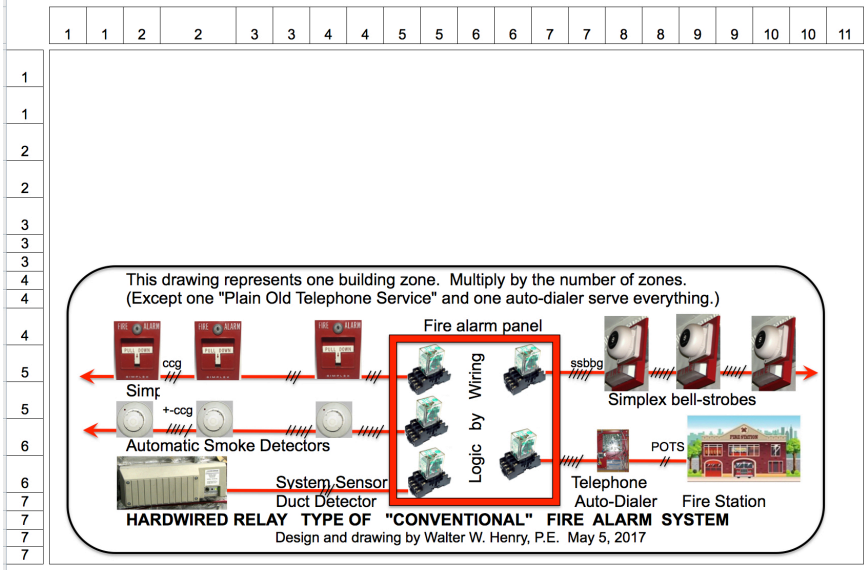
In these next pages, imagine that you are a Contractor trying to stuff all these wires into a few conduits running through a zone, and connecting down to all these devices. Then you have to keep up with which wires go to which devices. It's a huge challenge to "ring out" each wire to know where it shows up at ends and boxes. An addressable system with just a few cables would be oh, so much simpler for wiring. We'll get to that later. Here, get an appreciation for the electrician's challenge with conventional system wiring.

Here is the start of our example. See the picture, which is approximate, since quantities vary with manufacturers and models.

- In each zone, each type of initiating device has 3 wires.
- Each type of audio-visual annunciating device has 5 wires.
- Multiply this by the number of building zones.
- The pictured example shows 11 initiation wires and 5 indicator wires.
- Then the Relay Panel had multiple logic relays and output relays.

Credits:
Graphic, bell-strobe, auto-dialer, & duct detector are by Walter W. Henry, P.E., 2017.
Simplex pull station is used by permission of eBay seller CardBoardAttics, 2017.
Allen Bradley relay is used by permission of eBay seller DockGuys, 2017.
Fire station and smoke detector are from Thinkstock.

CONCEPT>HARDWIRED RELAY CONVENTIONAL FA SYSTEM.jpg



Elevators, Fire Pumps, and Kitchen

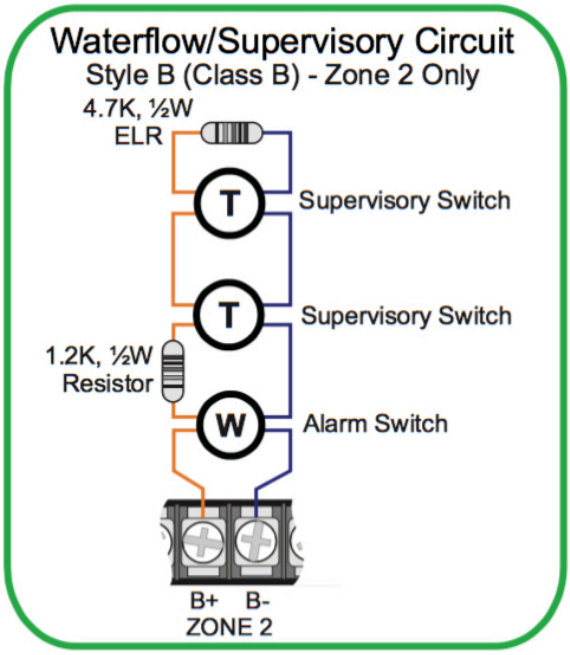
We covered pull stations, general smoke detectors, duct smoke detectors, and bell-strobes. Now here are some Conventional system items that connect.

- Each lobby smoke detector connects to the FAP, and FAP connects to each elevator controller.
- Fire Pump sends signals Running, undervoltage, and phase loss.
- Sprinkler system sends waterflow alarm and supervisory signals, and valve position signals. (Reference the picture).
- Clean Agent Extinguishing Systems such as argon or halon send Alarm, Trouble, and Supervisory signals.
- Kitchen hood extinguishers and kitchen heat detectors send signals.

Credit abbreviations: “doc.” indicates “document”. “Pub” indicates “publication”. The two terms mean the same: Informational text with images, whether print, pdf, or video.

Credit: Image is used by permission of Honeywell. See doc. 51840-A0.cdr

Honeywell FIRE.LITE ALarms MS-4 waterflow supervisory circuit doc 51840-A0.cdr.jpg



Honeywell FIRE.LITE ALarms MS-4

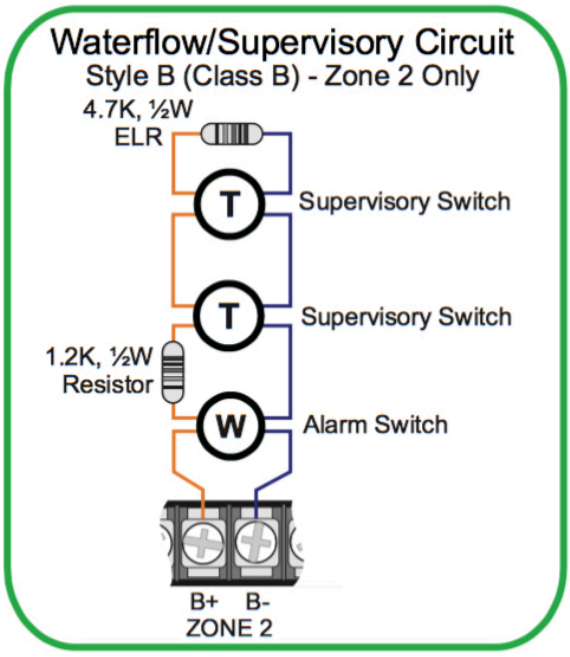
End-Of-Line Resistor

In the picture observe the End-Of-Line Resistor ELR. Each initiating circuit and each Annunciation circuit have an ELR. The ELR makes the circuit self-supervised, a requirement upon fire alarm systems. Here's how it works. Relays do the logic.

- In normal conditions, all the devices contacts are open, so the only current is a small current through the ELR.
- IF a device closes contacts, a large current flows and that's an Alarm.
- If the cable is cut or disconnected, no current flows and that's a Trouble signal.

Credit: Image is used by permission of Honeywell. See doc. 51840-A0.cdr

Honeywell FIRE.LITE ALarms MS-4 waterflow supervisory circuit doc 51840-A0.cdr.jpg



Honeywell FIRE.LITE ALarms MS-4

Remote Connections to a Conventional Panel

Now we have a few more items that connect to the Conventional Panel.

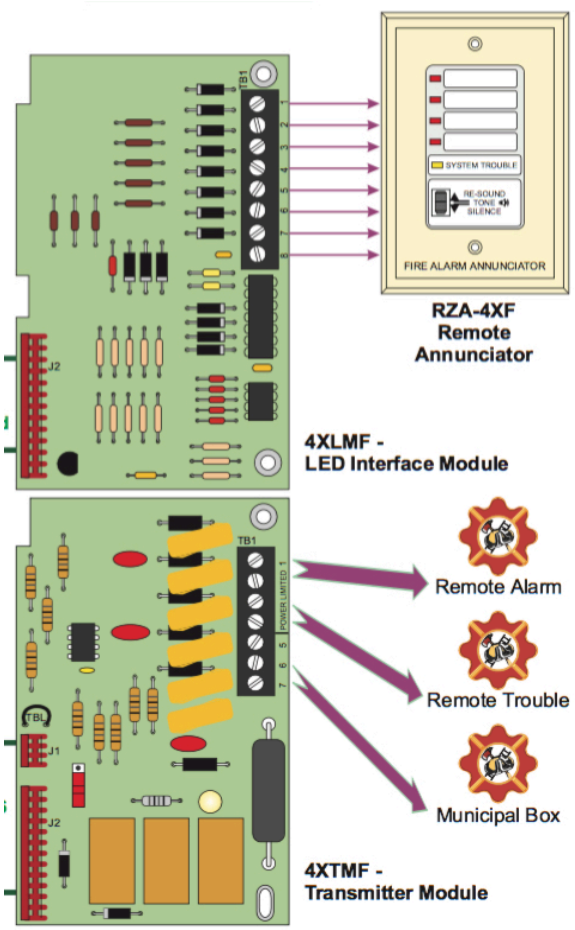
- The picture shows connections from
  - an automatic telephone dialer to signal the fire station,
  - a remote annunciator for the firefighters,
  - and remote signals to operating or maintenance people telling about alarm, trouble, or supervisory signals.

Credit: Image is used by permission of Honeywell. See doc. 51840-A0.cdr

Honeywell FIRE.LITE ALarms MS-4 doc 51840-A0.cdr ALARM AND ANNUNCIATOR OUTPUTS.jpg

Layout person, locate this on the right side of the screen full height,

with bullitts to the left



ALARM AND ANNUNCIATOR OUTPUTS
Honeywell FIRE.LITE ALarms MS-4

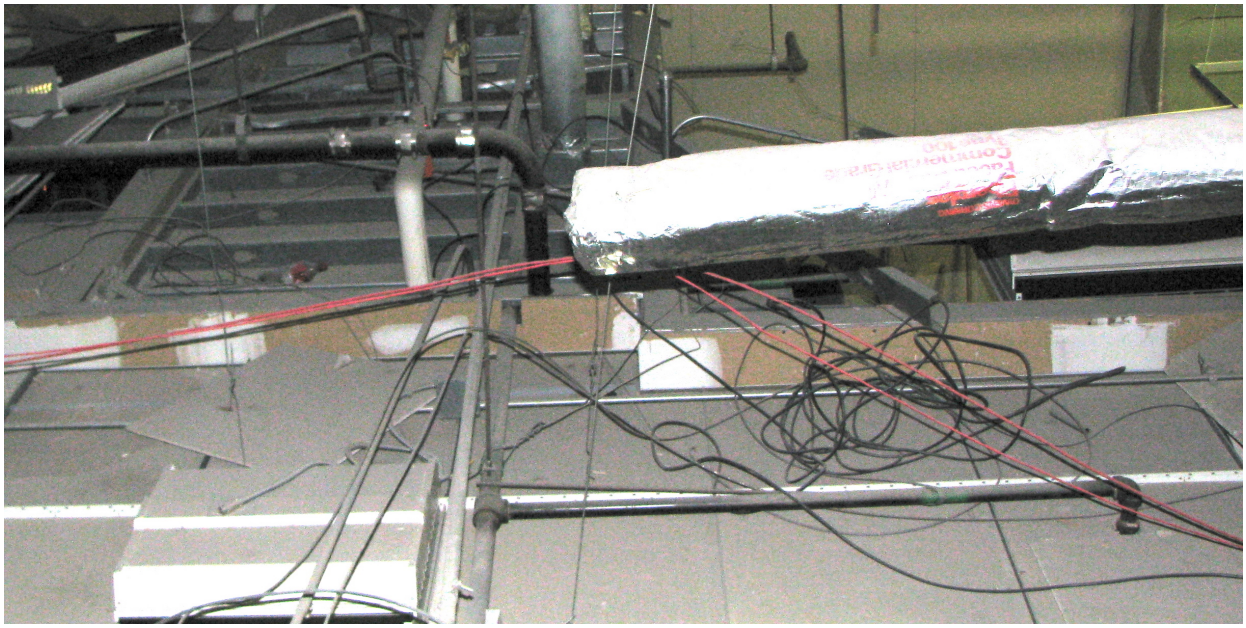
Remove Obsolete Wiring

Say that you are the Contractor about to cable a system. What if go above ceiling and feel like a meatball trying to walk through a bowl of spaghetti? What if the maintenance manager says that these are IBM cables from 20 years ago, and 2 vintages of fire alarm, and 3 vintages of HVAC controls, and office dictaphone from the 1960's, and CAT 1, CAT 3, and CAT 5 cables, and a layer of out-of-service lights? Is there a remote chance that a few more cables might drop the ceiling?

- Before quoting a project, inspect the existing building to determine work.
- Ask if the cables above ceiling are out of service. They'll know in a general way.
- Specify that the Contractor coordinate with the Owner, and remove out of service cables.
- Contractors are glad to perform this service if it is written into their scope of work and their bid so that they can get paid. Cleanup will help them in their new work.

Credit: photo by Walter W. Henry, P.E., 2008

Cabling mess on ceiling .JPG

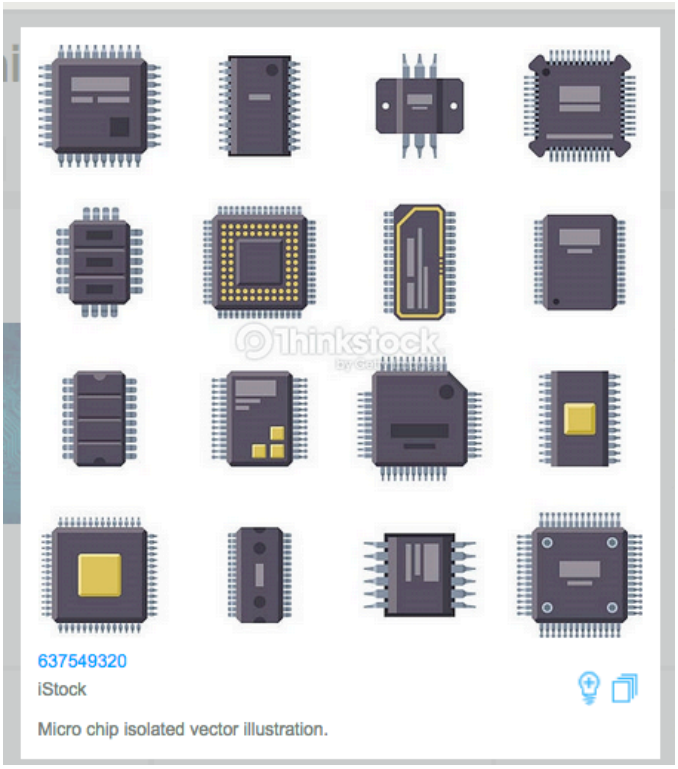


Beginning of Solid State Integrated Circuits

Solid State and Integrated Circuits, IC's, have tremendously changed the lives of all of us. Fire alarm capability hugely increased, and physical size decreased. Cabling tremendously simplified. For that reason we will give attention to I C developers.

- British engineer Geoffrey William Dummer presented the concept of integrated circuit at a 1952 conference in Washington, D.C. In September 1957 Dummer demonstrated an IC modeling a four transistor circuit.
- Jack St. Clair Kilby of Texas Instruments is credited with the July 1958 invention of integrated circuits, combining solid state transistors, diodes, resistors, capacitors, and inductors into small packages.
- In January 1959, Robert Noyce of Fairchild Semiconductor independently brought forth the IC idea.

Credit: Thinkstock 637549320



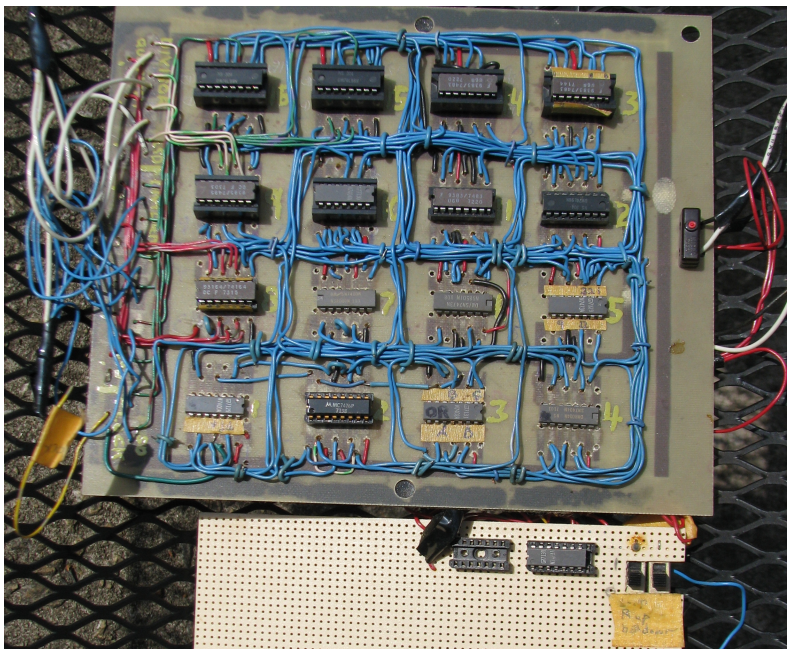
Early Applications of IC's

- Motorola and Signetics announced their first chips in 1962.
- Texas Instrument SN514B was the first IC to orbit earth, during November 1963.
- Between 1965 and 1967, Jack Kilby designed a pocket size four function calculator which could add, subtract, multiply, and divide, The TI Pocketronic" was launched during April 1971. The four-function calculator cost $150 ($910 in 2017). Pocketronic used a thermal printer since LED was still very young.
- In 1968, Robert Noyce and Gordon Moore co-founded Intel which later became famous for computer integrated circuits. "Intel Inside".
- In 1969, Jerry Sanders and seven colleagues started Advanced Micro Devices, AMD.
- In 1979, Simplex Model 2001 conventional fire alarm panel introduced solid state modules to replace electro-mechanical relays.

The photo shows this author's 1973 "digital divider" senior project at LeTourneau College, Texas. By then, general purpose integrated circuits were available. His catalogs were Texas Instruments and Fairchild. He penciled logic trains and digital diagrams onto notebook paper. Wires were soldered to the pins of seventeen IC "chips". Inputs were 4 divisor and 8 dividend wires hardwired to 6 volts from half of a tar-top car battery. Outputs were 8 quotient wires. measured "volts" or "no volts" with a voltmeter. The red button manually stepped through the logic.

Credit: photo by Walter W. Henry, P.E., 2017

WWH Digital Divider IMG_4704



Old-Fashion Lightning Arresters

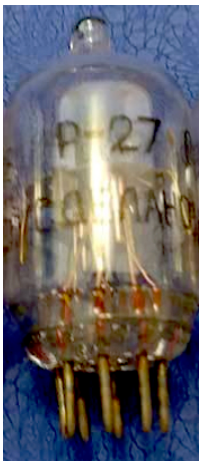
Today, it is said that outdoor transformers have “Lightning Arresters” and that panels, meters and surge strips contain “Surge Suppressors”. But before the 1990’s, everything was called a “Lightning Arrester”.

- “Plain Old Telephone Service” and electro-mechanical relays generally withstood EMP electromagnetic pulses. EMP came from lightning, powerline switching, circuit breaker operation, or switching motors.
- Old-fashioned Lightning Arresters dumped excess energy. Examples are knurled rods, carbon rods encased in sand, inert gas tubes, surge capacitors, arc riser rods, insulated isolated transformers and “Osborne” protectors.

About 1983, a Contractor called this Engineer about lightning hitting the electric service entrance, a motor control center, at a wastewater treatment plant under construction. The surge capacitor exploded and its wire insulation was melted for 3 feet. But the motor control center was okay. The Contractor replaced the capacitor under the one year Contractors warrantee. At the Engineer’s request, the utility company extended the 12.5kV pole line for a pole span past the service entry riser. Then the double voltage “electric hammer” would hit the end pole lightning arrester instead of the service riser.

Credits:
Delta LA603 photo by permission of eBay seller CircuitBreakerService, 2017
R-27 lightning arrestor photo by permission of eBay seller Salmi_d, 2017

DELTA ARRESTOR LA-603 by CircuitBreakerService.jpg
eBay seller salmi_d. R-27 lightning arrestor.jpg



Modern Surge Suppression

- During the 1980's and 90's, most everything went "electronic".
    - systems panels, office equipment, desktop computers, and lighting.
    - Even some new circuit breakers were electronic.
- When copiers and other equipment failed, people worried if it was their fault.
- "Surge Suppression" manufacturers sprang up and visited with new devices.
- Reps talked about fuses, zeners, transzorbs, capacitors, Metal Oxide Varistor MOVs, Bolt-in, Plug-in, solder-in, short bus, and PC board burnouts.
- After zoning out, this Engineer asked representatives if the suppressors came with a bottle of snake oil to activate them. We never saw a bottle of it.
- Gradually the terms were clarified: "Lightning Arresters" for outdoors, and "Surge Suppressors" for indoors.
- In fact the new suppressors did seem to reduce incidents of damage. The self-blame level of office workers went way down when equipment lasted longer.
- We began specifying entire systems of suppressors
    - At the outdoor transformer, main switchboard, and panels serving electronics. Gradually, most panels' loads became electronic.
    - We beefed up the grounding to dissipate the energy away from equipment.
- This Engineer asked Manufacturer reps if their fire alarm equipment had built in suppressors. Neither this Engineer nor reps could find any.
- So this Engineer specified an external suppressor at each system's panel, naming at least three acceptable manufacturers. If a panel happened to have suppression in it, that would be extra protection.
- For example, ASCO Model 420 protects fire alarm, ECS or security panels line to neutral and neutral to ground.

Credit: Image is used by permission of VertivCo ASCO Power Technologies

ASCO SURGE SUPPRESSOR 400 series for FAP.jpg

As firefighting technology developed, firefighters wanted more answers.

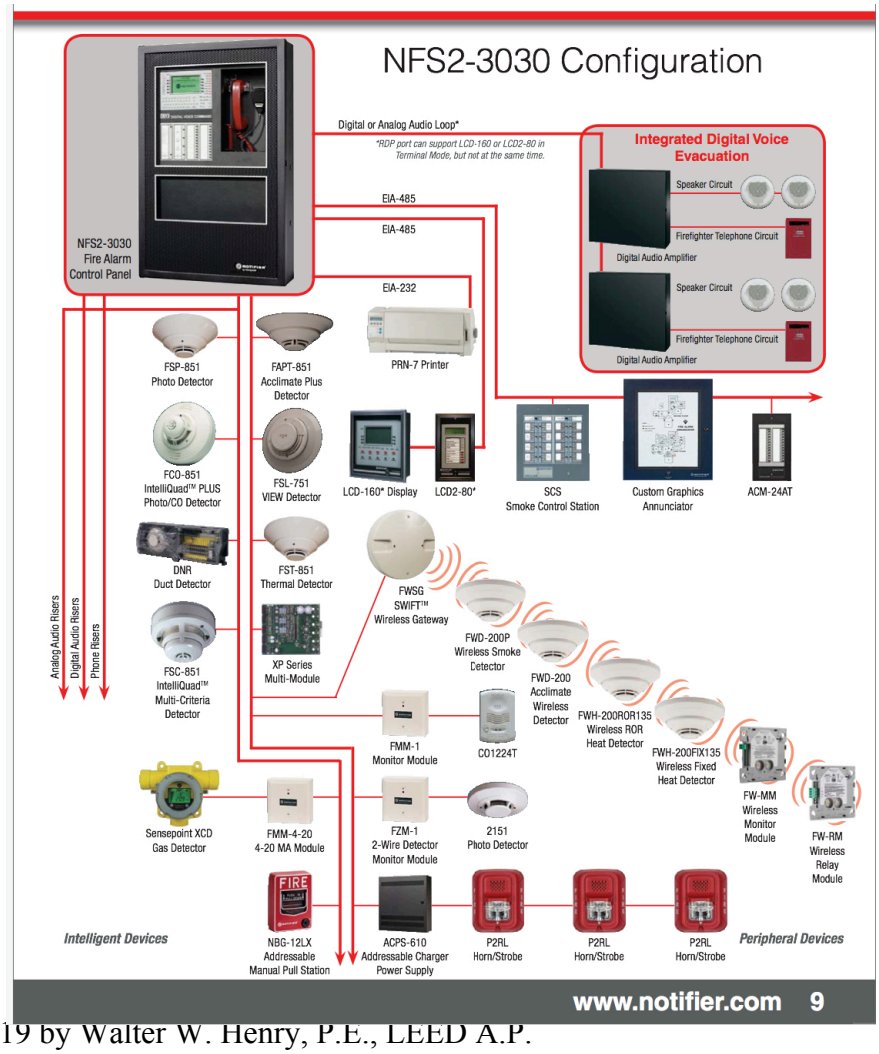
ADDRESSABLE FIRE ALARM SYSTEMS

Addressable Systems Progressed.

- Addressable systems answered the firefighter question "Which specific initiation devices are indicating a fire?"
- Addressable Systems Became Established from 1980 through 2000.
- Addressable worked. Confidence increased. Sales increased so cost decreased.

Credit: Image is used by permission of Honeywell. See doc. NF_BR_PI-2_02-17_web_pdf

Add.01 2017-09-15, Notifier NFS2-3030 riser, pub NF_BR_PI-2_02-17_web_pdf.jpg
Producer: White background. Don't know why copy to here turns it pink. etc for others too.

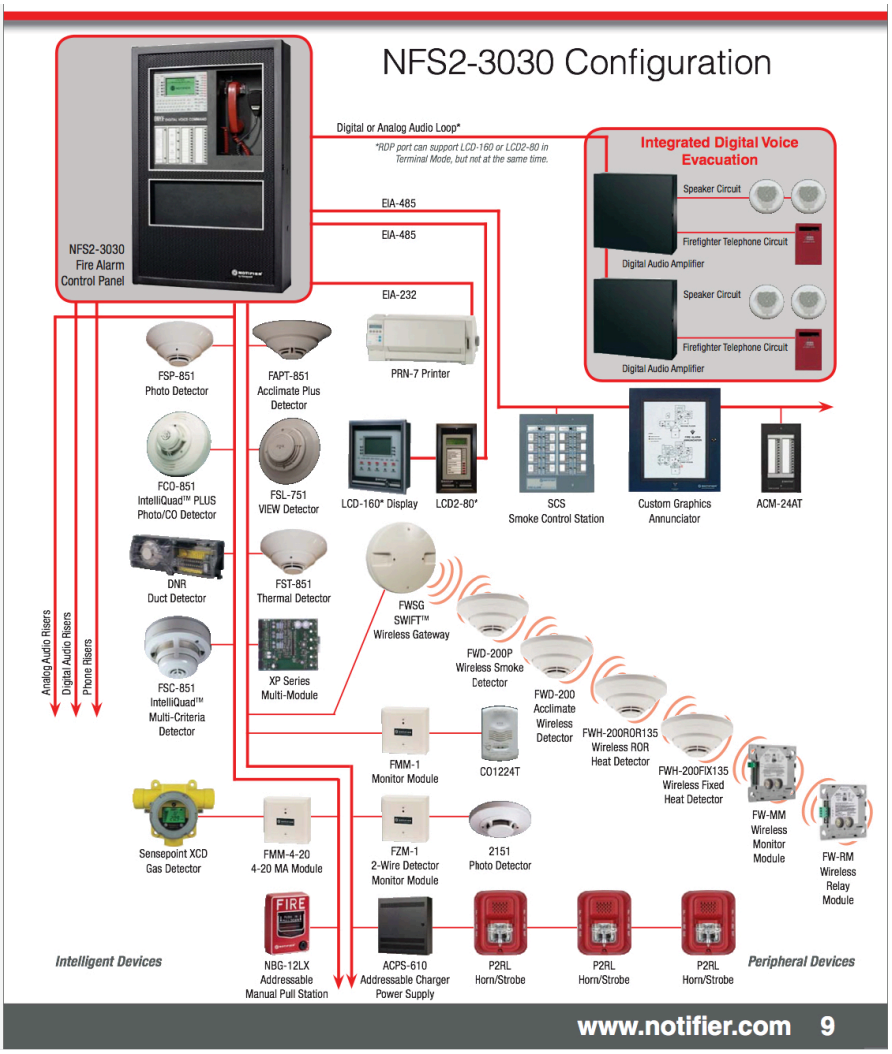


Addressable Cabling is Simpler Than Conventional System Cabling.

- Each device requires less cables.
- Each cable can handle more devices, perhaps 60 devices or more.
- Perceive the "big picture" of this riser diagram. Envision the variety of devices per cable.

Credit: Image is used by permission of Honeywell. See doc. NF_BR_PI-2_02-17_web_pdf

Add.01 2017-09-15, Notifier NFS2-3030 riser, pub NF_BR_PI-2_02-17_web_pdf.jpg



Fire Alarm Readout Information

- Addressable systems with Readout help firefighters determine fire alarm answers. See the picture.
- Which devices “point” number is it?
- When did the event begin or end?
- Is this true alarm or is a detector malfunctioning?
- Is the fire spreading, in what direction, and how quickly? See the sequence of signals.
- The system notifies appropriate personnel not just the fire station.

Credit: Image is used by permission of Honeywell. See doc. DN_60548_pdf

Add.01,Notifier LCD2-80 annunciator, pub DN_60548_pdf

Fire Alarm Graphic Annunciator Information

- Graphic Annunciators can contain this information.
  - Location of pull stations and auto detectors, blinking if activated
  - Positions of firefighting water supplies,
  - Evacuation routes and firefighter access routes,
  - Shut-offs for gas, electric power, and HVAC,
  - Locked spaces which do not release upon fire alarm,
  - Dangerous substances, dangerous, machinery, dangerous conditions

Some companies make their own graphic screen with driver. Other companies have a third-party to manufacturer the screen and install the driver furnished by the fire alarm manufacturer.

Credit: Image is used by permission of Honeywell. Image is about 3 minutes into "ONYX FirstVision Sensing Video (SWF)"

Notifier First Vision annunciator video, 3_26s, firefighter touching annunciator screen.jpg

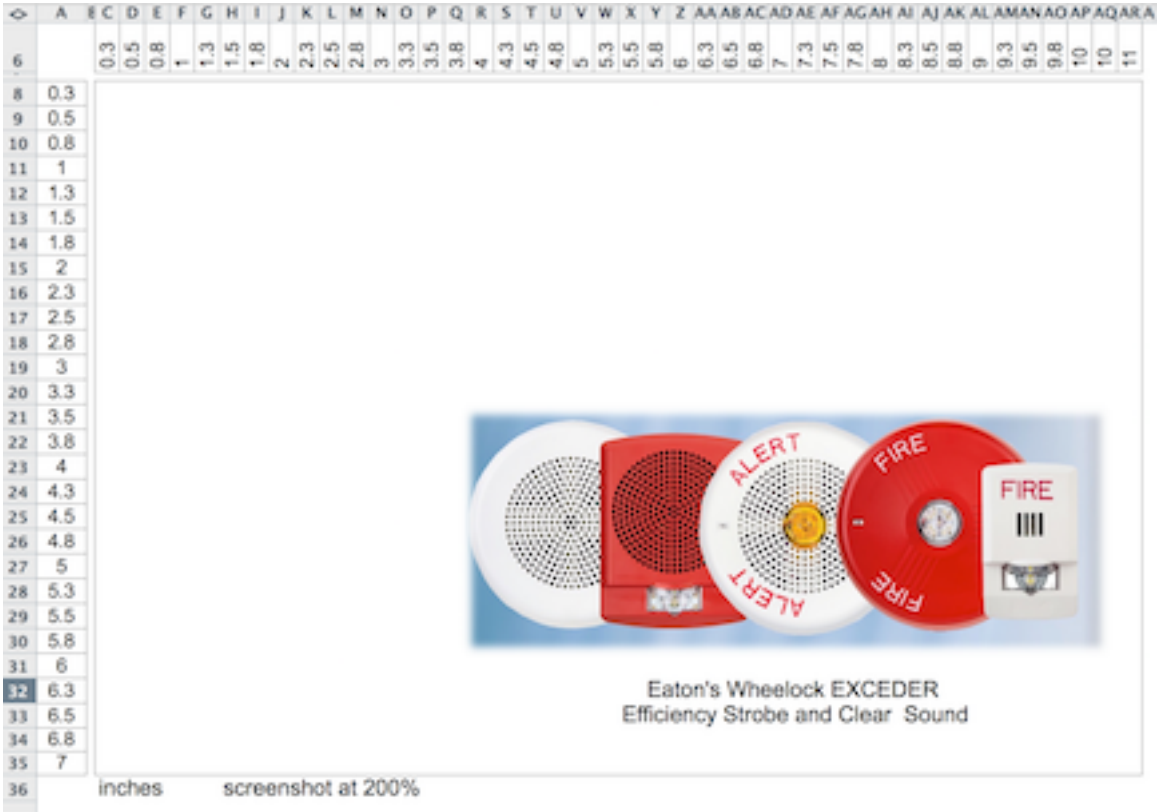
Audio Visual Communication Improvements

During the 1980s and 1990s, as addressable systems were developed, audio visuals improved.

- Speakers replaced horns to have voice information and selectable tones.
- The system and speakers give 300 to 8000 Hertz and digital clear sound.
- LED strobes lower the visual power requirement.

Credit: Image is used by permission of EATON. Found May 2017 at <www.cooperindustries.com/content/public/en.html> Product: Life Safety and Mass Notification

Eaton's Wheelock Exceder LED efficiency strobe & clear sound.jpg

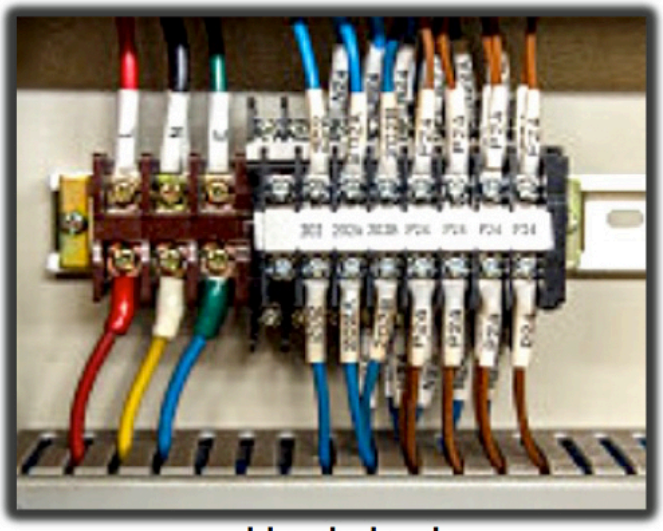


Programming

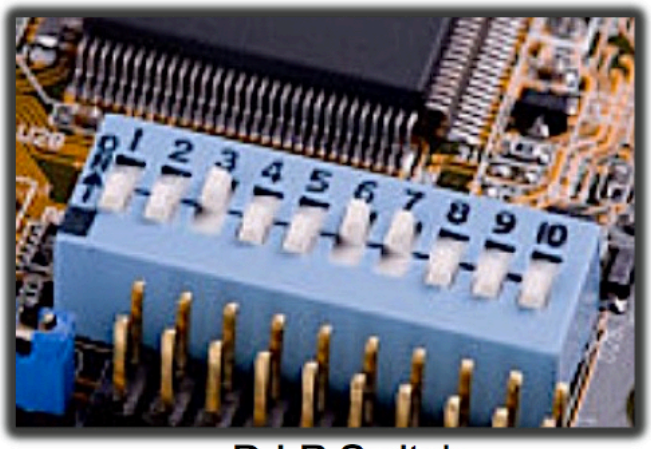
- Logic changes are made with “software” instead of “hardwire rewiring”.
- Addresses were made with dual in-line pin switches on each device.
- Now device addresses can self-program.
- The pictures demonstrate “Hardwiring” versus “DIP switch” programming.

Credit: Graphic by Walter W. Henry, P.E. Images: Thinkstock 468783170 & 91410416

Hardwired vs DIP Switch.jpg
Producer, you may duplicate/trim to get separate pics, and place side by side.



Hardwired



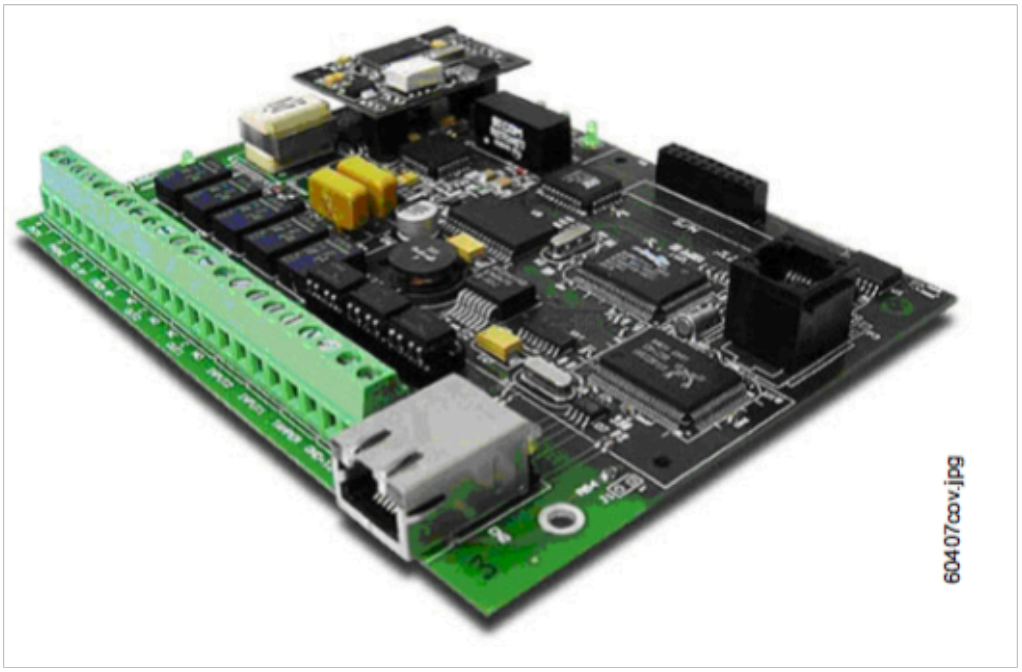
D I P Switch

Notification to the Firefighters

- Formerly,
  - The FA panel auto-dials a POTS line to the firestation monitor panel.
  - DVACS (Dedicated Voice Activates Communication System) was a more secure alarm system.
  - The fire station just knew that the fire was at a certain building.
  - Firefighters had to travel to the building and study the building's annunciator for details. What if the fire was at the annunciator?
- Now communication paths can be
  - Internet Protocol over internet, Cellular, or Fiber optics.
  - Firefighters can know a lot more before arrival, to plan ahead better.

Credit: Image is used by permission of Honeywell. See doc. DN-60408:D3

Honeywell Notifier IP FIRE ALARM COMMUNICATOR.jpg



Honeywell NOTIFIER IPDACT-2/2UD
IP FIRE ALARM COMMUNICATOR
from document DN-60408:D3 • 10/15/2014

Addressable Initiating Devices

- lnitiating devices announce a problem situation.
- The term “addressable” indicates that the Initiating Devices became individually supervised and addressed.
- Detectors can be tested with a magnet without entire system activation.
- Smoke detectors became self-diagnostic , self-adjusting, and dirt warning.
- LEDs on detectors indicate test response without entire system activation.
- Device activation is still required to verify “everything” in the detector.

The T-bar styled pull station and the smoke detector are examples of initiating devices.

Credit: Thinkstock 486132633 & 538034606

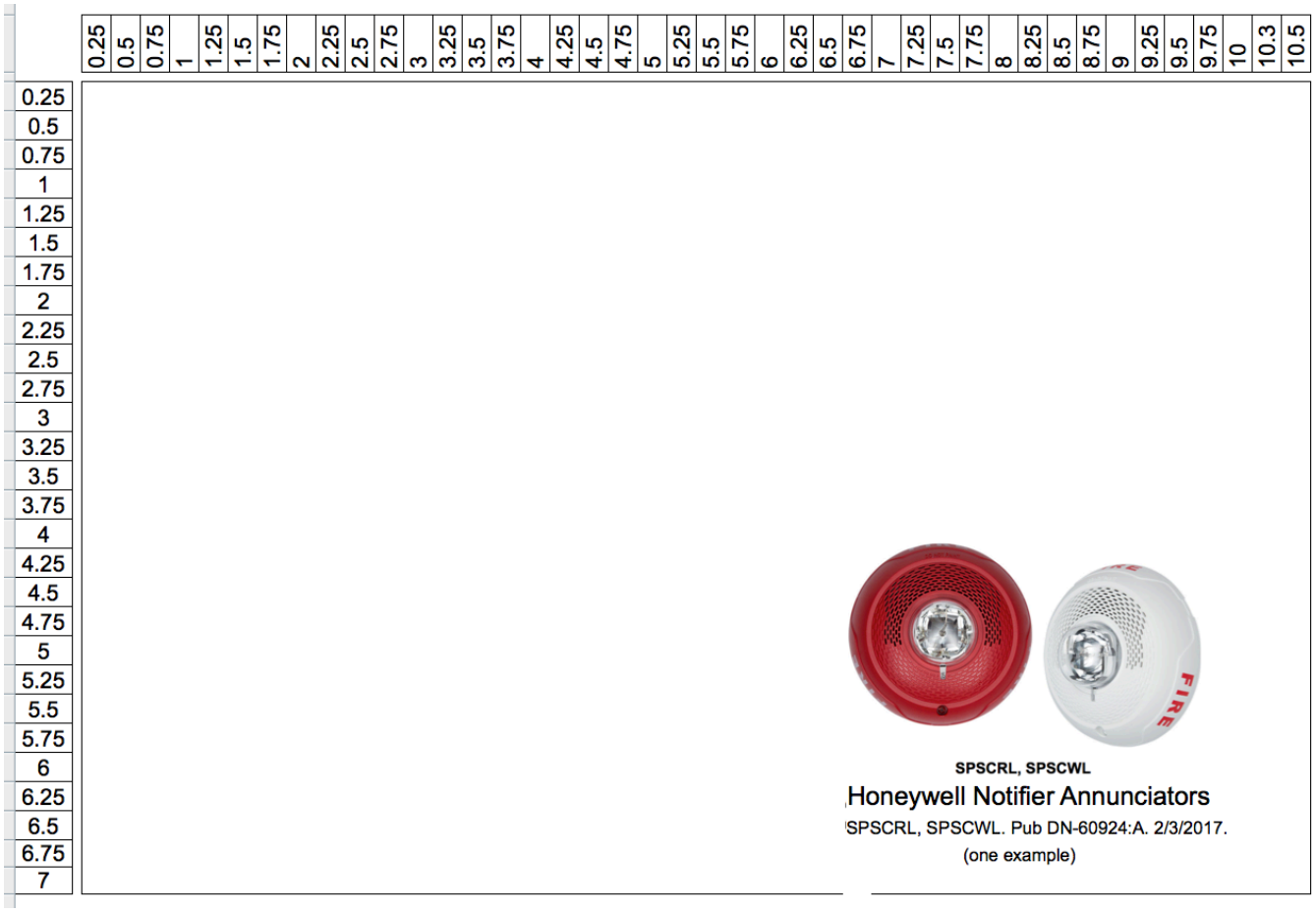
Producer, trim images.

Addressable Annunciating Devices

- Until about 2010, speakers and strobes remained zoned.
- They were not addressable and required significant power.
- After 2010, electronic individually addressable speakers and strobes became available; individually supervised and addressed.
- Audio became digital which improved clarity.
- Audio through glass fiber became an option.
- Different messages could broadcast to different areas.

Credit: Image is used by permission of Honeywell. See doc. DN-60924:A

Honeywell Notifier Annunciators SPSCRL, SPSCWL.jpg

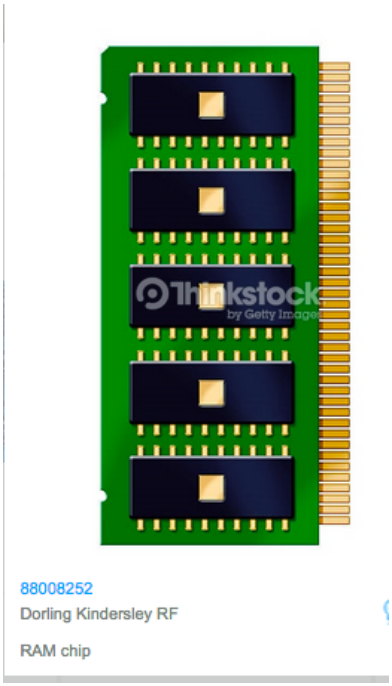


Credit: Thinkstock 88008252 & 648300902

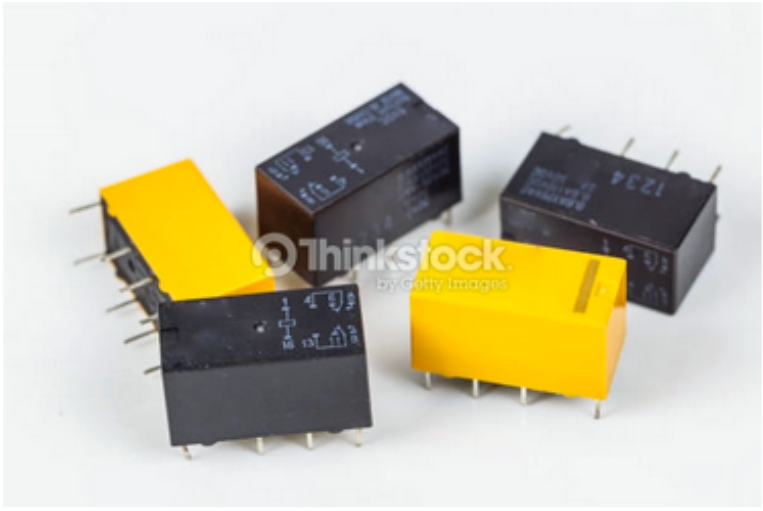
ACTIVITY #2

Match the term with the image.

Integrated circuits on a computer RAM board



Discrete relays of a miniature style



MAGNITUDINAL CHANGES TO FIRE ALARM AND SECURITY SYSTEMS

911 September 11, 2001, World Trade Towers

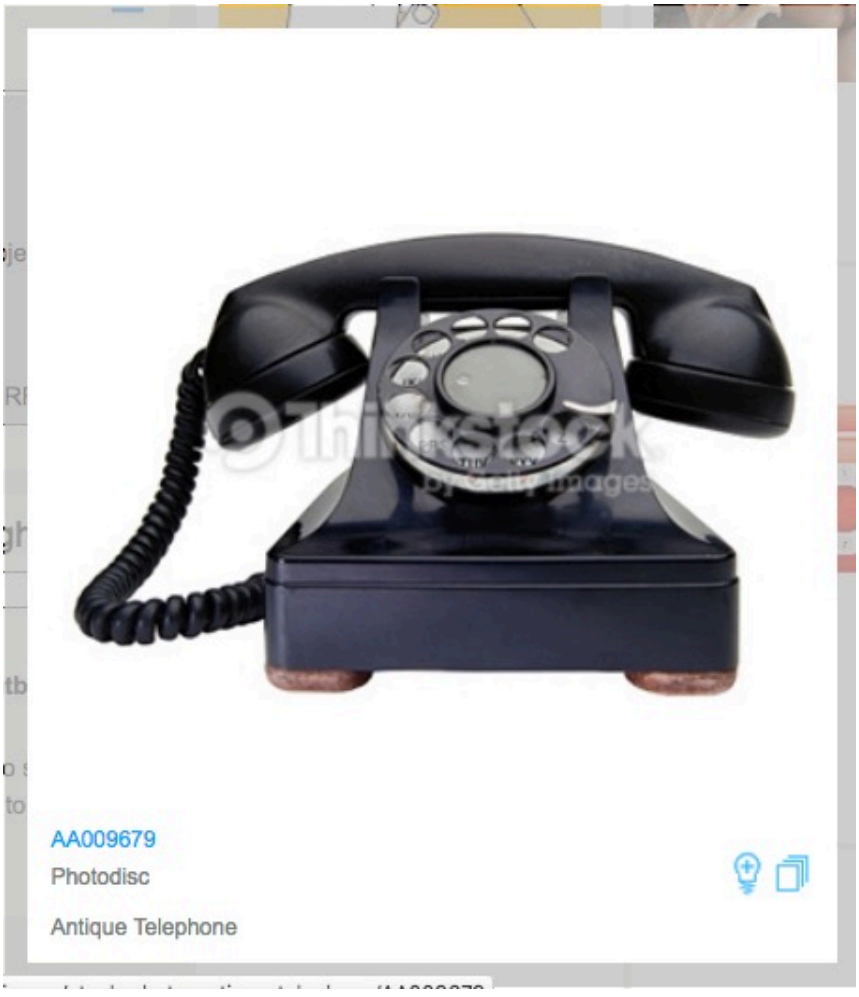
- 911 emphasized a need to improve Mass Notification communication
- among responders, Owners ,and occupants,
- with information, instructions, and notifications
- from fire alarm, security and other systems.
- After 911, the design, manufacturing and construction community scrambled
- to pull systems together, fill gaps in technology, and adjust codes to allow it.

Credit: Thinkstock 78455953

POTS (Pronounced P O T S)

- Over 100 years, the fire alarm industry and the NFPA relied on reliable “Plain Old Telephone Service” purchased through rates and tax subsidies.
- POTS communicated voice and alarm signals during extended outages due to power backup from the central office.
- Fire alarm, security and the NFPA depended upon POTS.
- By the late 1990s, three technologies might replace POTS Plain Old Telephone Service.
    - IP Internet protocol
    - MFVN managed facilities voice network
    - GSM Global system for mobile communications
- But each customer must have their own backup power, and was a question whether wireless would keep working when we need to communicate the most.

Credit: Thinkstock AA009679

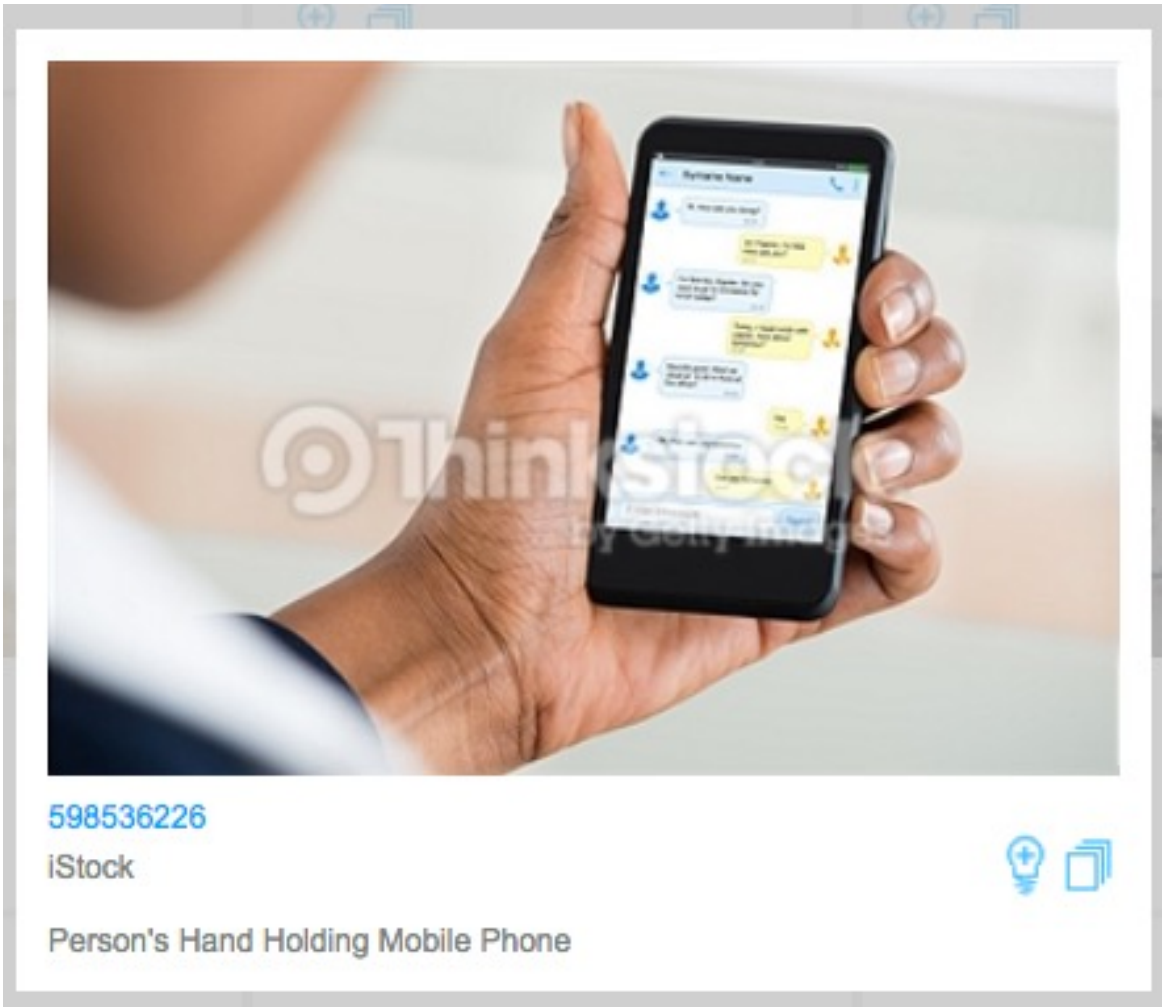


Broadband Impetus

- During 2002 and 2003, FCI and introduced broadband technology to the fire alarm industry.

- By 2010, newer generations expected more technology at their fingertips:
  - cell phones, Voice Over Internet Protocol, wireless devices,
  - and voluminous information with ease of access.
- AT&T
  - was losing hundreds of thousands of POTS landlines per month
  - and wanted to obsolete the POTS service.

Credit: Thinkstock 598536226



NFPA and Communication

- NFPA included new broadband communication technologies into 2010 NFPA 72.
- NFPA saw that “broadband” had matured to address
    - reliability and
    - redundancy.
- Broadband systems tested much more often than 24 hour intervals.

Credit: Graphic by Walter W. Henry, P.E., 2017.
Thinkstock, top half of pole 57856 8600, & 655331564

POTS & Broadband.jpg

Exit Speakers

- The exit speakers concept developed during the 2000's.
- Smoke obscures exit signs and familiar surroundings.
- Hiss sound is directional since hiss covers the range of hearing.
- So a hiss sound can help direct people to refuge, stairs or exits.
- Partially deaf people may hear a hiss better than a tone.
- Fire alarm tones are not very directional compared to a hiss.

Credit: Image is used by permission of Honeywell. From doc. "ONYX_ExitPoint_pdf"

NOTIFIER Onyx ExitPoint video 4m 52s into video.jpg

ECS EMERGENCY COMMUNICATION SYSTEMS

- The idea of an ECS is that a simple quick instruction will “seamlessly” access many systems in a hurry.
- Emergency Communications Systems send real-time information through
    - EVACS Emergency Voice and Alarm Communication Systems,
    - MCS Mass Communication Systems in-building and wide-area, and
    - MNS Mass Notification to Distributed Recipients.
- ECS can deliver time-sensitive information for a few or for thousands.
- ECS may be utilized by residential facilities, universities, colleges,
- business, government, or other facilities.

Credit: Image is used by permission of Honeywell. From doc. DN-60772_ A6 10-23-2015

Notifier’s First Command NFC-50/100E pub DN-60772_A6 10-23-2015.jpg

ECS Messages

- An ECS is intended to communicate concise, timely, event-specific notices
  - concerning fire, human- caused events (accidental and intentional),
  - accidents, natural disasters and other dangerous situations.
- Other examples include smoke, evacuation, rescue, homeland security,
- missing person, wanted person, crime, intrusion, or hazards.

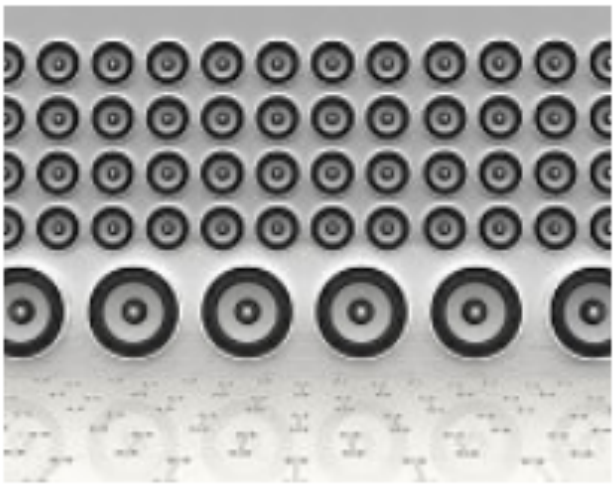
Credit: Thinkstock 101102845

NFPA 72 Makes a Place for Emergency Communications Systems

- In year 2010, NFPA 72 was renamed as "NFPA 72 National Fire Alarm and Signaling Code".
- NFPA 72 added Chapter 24: Emergency Communications Systems
- Chapter 24 combined supervised EVACS with unsupervised MNS.
- Chapter 24 emphasizes **INTELLIGIBILITY FROM MANY** speakers
- rather than **LOUDNESS FROM FEWER** speakers.
- Therefore Chapter 24 wants **MANY** building systems to help with ECS.
- NFPA 72 Chapters 12 and 24 want survivability of Circuits and Pathways.
- An NFPA 72 Risk Analysis comes first.

Credit: Thinkstock 200369004 – 001 & 606232868

Layout person, show both pictures, and use the word VERSUS between them.



200369004-001

DigitalVision

606232868

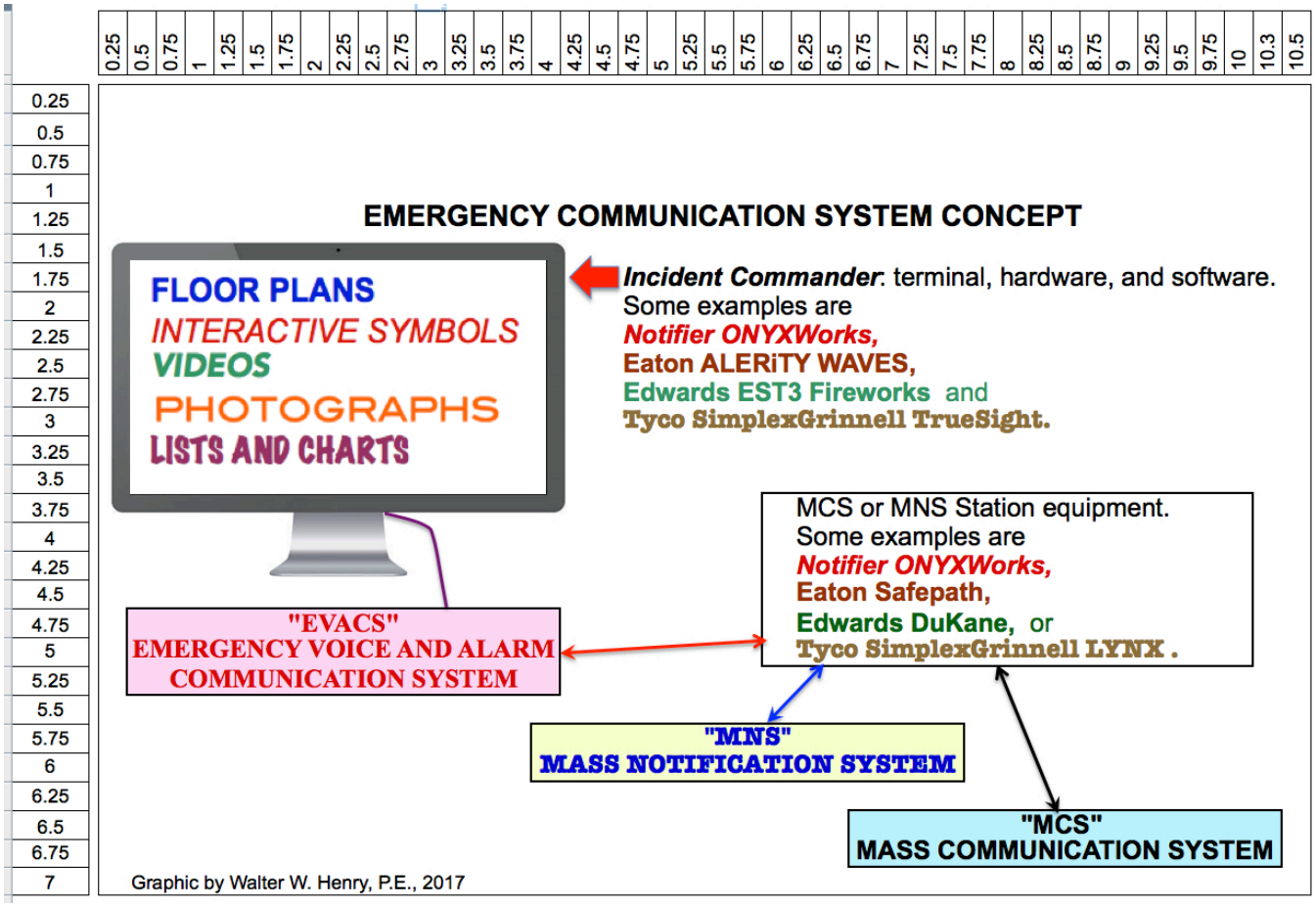
iStock

Example of an Emergency Communication System

- The ECS might be considered to have three parts: EVACS, MNS, and MCS.
- The Incident Commander allows a few operators to handle the three systems.
- Modern systems can broadcast SIMULTANEOUSLY to some or all areas,
- with a different programmed message to selected areas.
- Or the Operator can speak to selected areas.

Credit: Graphic by Walter W. Henry, P.E., 2017

Emergency Communication System Concept.jpg



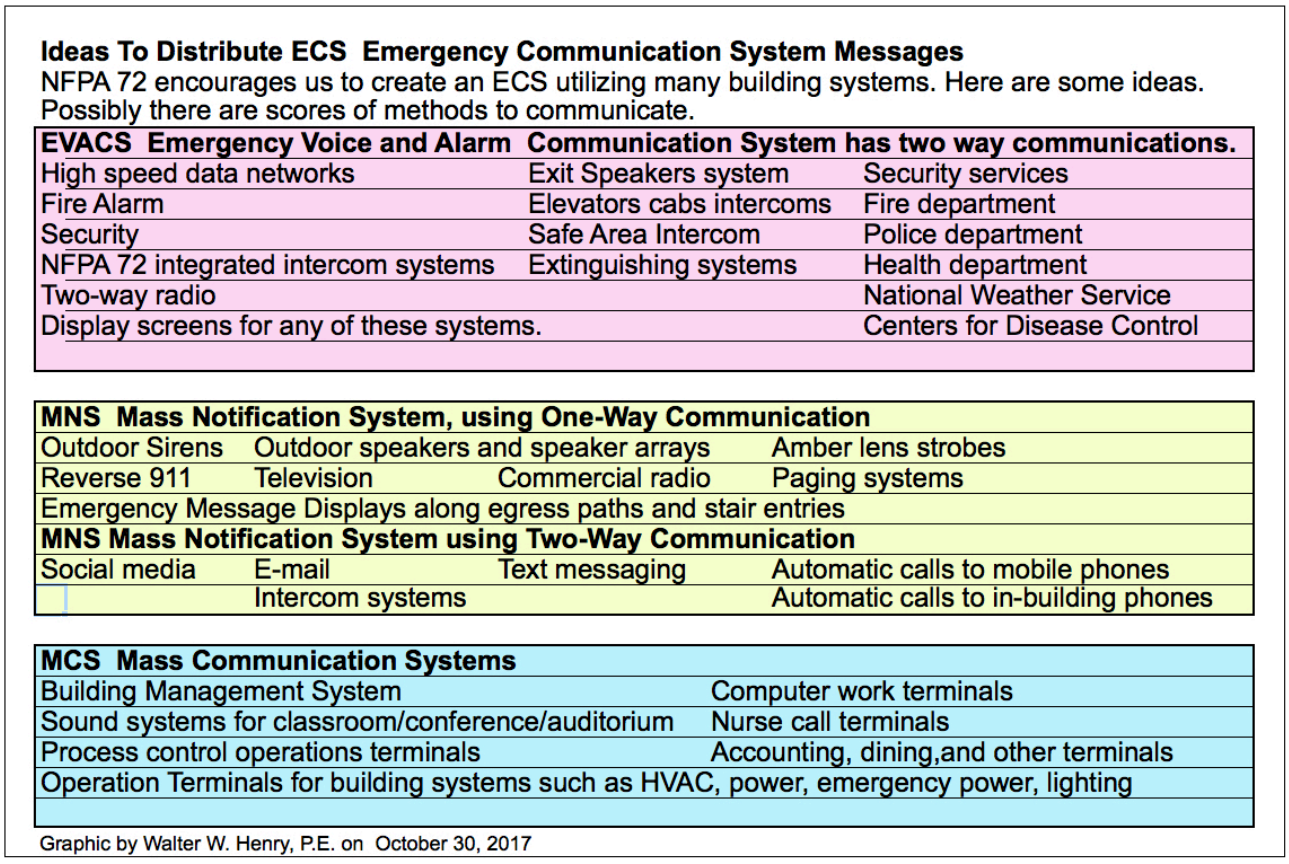
Ideas To Interface ECS With Building Systems

These are some ideas to distribute Emergency Communication System messages.

(Reader, say the title and introductory line. Then read the chart, quickly. Follow horizontally along a horizontal row, (not as columns), then go to the next row.

Credit: Graphic by Walter W. Henry, P.E., 2017

Ideas to Distribute ECS Messages.jpg



Ideas To Distribute ECS Emergency Communication System Messages

NFPA 72 encourages us to create an ECS utilizing many building systems. Here are some ideas. Possibly there are scores of methods to communicate.

EVACS Emergency Voice and Alarm	**Communication System has two way communications.**	
High speed data networks	Exit Speakers system	Security services
Fire Alarm	Elevators cabs intercoms	Fire department
Security	Safe Area Intercom	Police department
NFPA 72 integrated intercom systems	Extinguishing systems	Health department
Two-way radio		National Weather Service
Display screens for any of these systems.		Centers for Disease Control

MNS Mass Notification System, using One-Way Communication			
Outdoor Sirens	Outdoor speakers and speaker arrays		Amber lens strobes
Reverse 911	Television	Commercial radio	Paging systems
Emergency Message Displays along egress paths and stair entries			
MNS Mass Notification System using Two-Way Communication			
Social media	E-mail	Text messaging	Automatic calls to mobile phones
	Intercom systems		Automatic calls to in-building phones

MCS Mass Communication Systems	
Building Management System	Computer work terminals
Sound systems for classroom/conference/auditorium	Nurse call terminals
Process control operations terminals	Accounting, dining,and other terminals
Operation Terminals for building systems such as HVAC, power, emergency power, lighting	

Graphic by Walter W. Henry, P.E. on October 30, 2017

EVACS EMERGENCY VOICE AND ALARM COMMUNICATION SYSTEMS

Say EVACS like this: "ee-vacs".

- EVACS provides TWO WAY communication among responders, staff and persons in need.
- EVACS circuits ARE supervised for correct function.
- EVACS can instruct the public, not just saying that there is an alarm.

Credit: Image is used by permission of Honeywell. From doc. DN-60772_ A6 10-23-2015

Notifier's First Command NFC-50/100E pub DN-60772_A6 10-23-2015.jpg

Emergency Voice Evacuation System
NOTIFIER NFC-50/100E
pub Notifier DN-60772_A6 10-23-2015

What are Some EVACS Messages?

- EMERGENCY VOICE AND ALARM COMMUNICATION SYSTEMS
- Staff or responders instruct about shelter-in-place, evacuation, relocation or other action.
- Some EVACS can filter details to responders and necessities to occupants.
- pre-recorded voice or tones can distribute as appropriate.
- Some EVACS furnish NFPA 720 UL464 520 Hertz tone for sleeping area alarm.
- EVACS might adapt to serve Areas of Rescue as “Rescue Assistance Communication System”.

Credit: Thinkstock 626184122

Some Other EVACS Functions

- EMERGENCY VOICE AND ALARM COMMUNICATION SYSTEMS
- Reverse 911 allows responders to mass notify those who signed and set up their phones for it.
- NFPA 72 Combination Systems can also page, notify or play music.
- EVACS should be easy to use. Staff should be trained to use EVACS.
- People regard higher credibility and confirmation to messages from multiple communication methods.

Credit: Image is used by permission of Comtran Cable LLC.
Image in video <www.youtube.com/watch?v=O8rwKOXq2tE >, Dec. 2016.

Comtran, People exiting building.jpg

MASS NOTIFICATION SYSTEMS

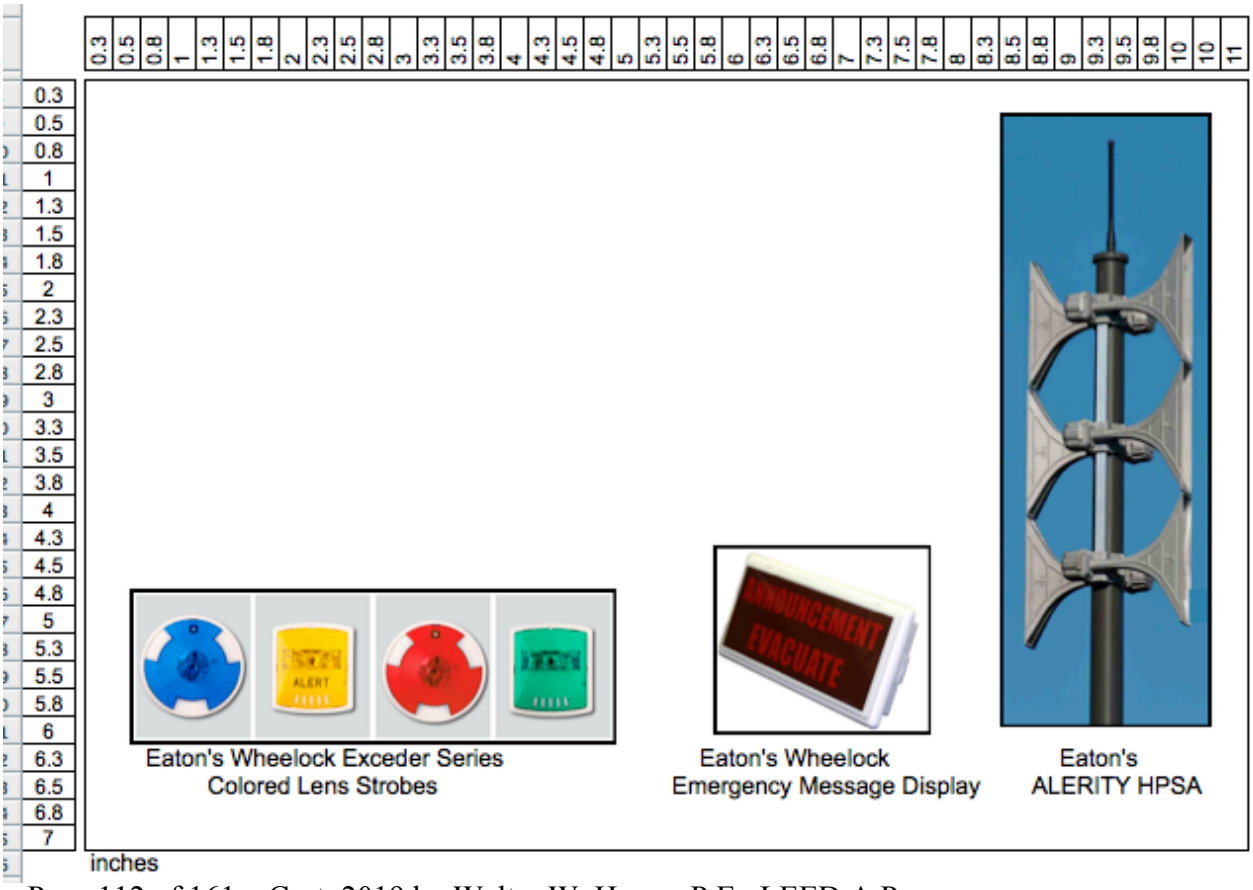
One-Way MNS Mass Notification System

- Some Mass Notification is ONE WAY messaging.
- MNS circuits ARE NOT supervised for correct function.
- Another term for MNS is MCS Mass Communication System.
- Examples are strobes, message displays, and loudspeakers.

Credit: Graphic by Walter W. Henry, P.E., 2017.
Images are used by permission of EATON. Found May 2017 at <www.cooperindustries.com/content/public/en.html> PRODUCTS> LIFE SAFETY AND MASS NOTIFICATION> NOTIFICATION> Mass Notification/Emergency Communication Solutions.
Colored Lens> ExcederColoredLensSellSheet_5_13_11.pdf ;
Emergency Message Display> TechData TD450084EN;
Speakers> HPSA7100_Brochure.pdf .

Eaton Mass Notification strobe,display,speaker.jpg

Producer, trim off border.



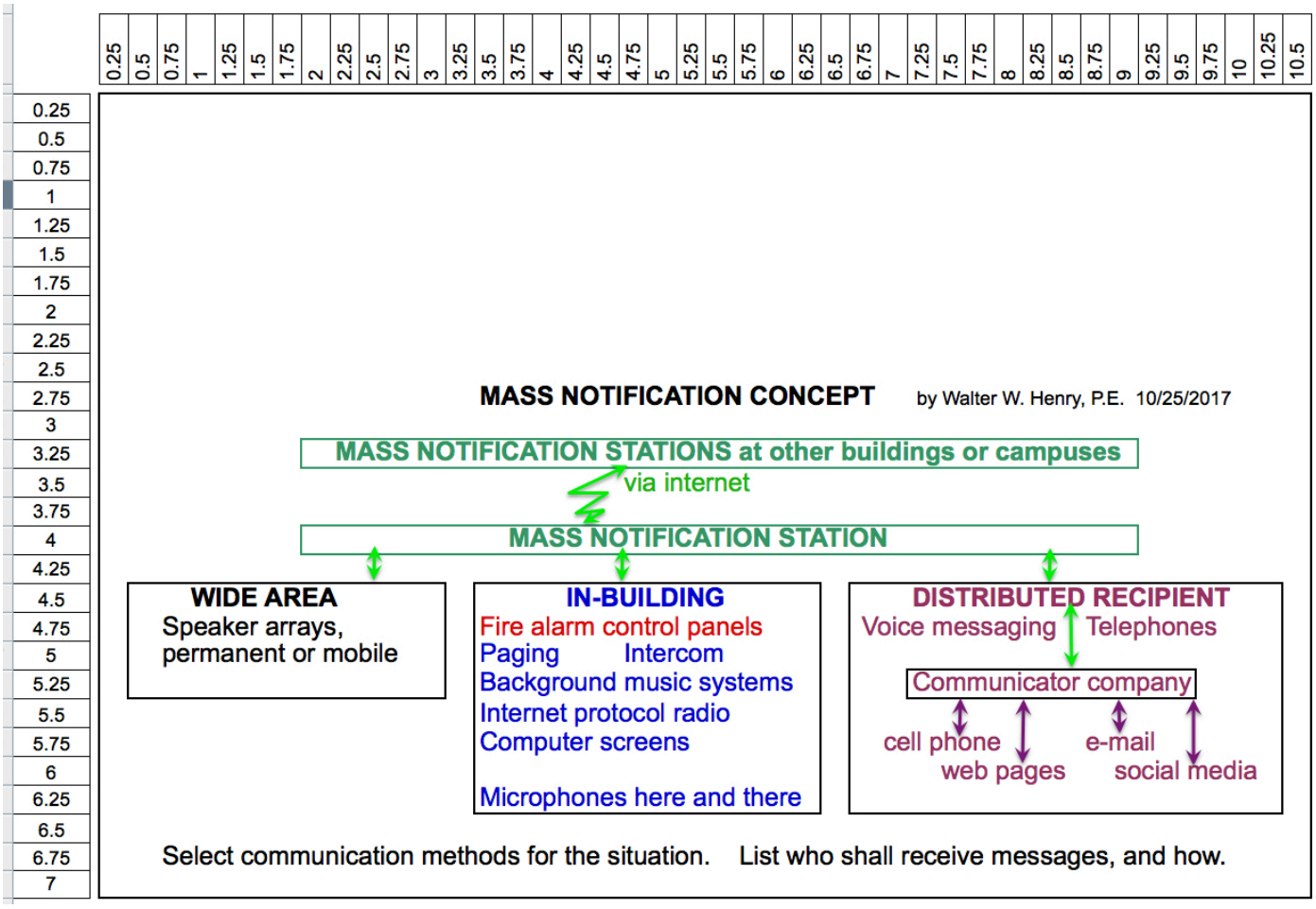
Mass Notification Concept

- Design the Mass Notification System to meet the Owner needs.
- MNS might divide into three categories.
- WIDE AREA announces one-way to large areas using large speakers.
- IN_BUILDING announces one-way through existing building systems.
- DISTRIBUTED RECIPIENT talks two-way to people wherever they are.
- One MNS station can communicate to other buildings, campuses or cities.

Credit: Graphic by Walter W. Henry, P.E., 2017

MASS NOTIFICATION CONCEPT.jpg

editor, trim the border, keep the graphic.



Emergency Management Program

- An Owner's "Emergency Management Program" should include
  - a risk analysis,
  - local AHJ requirements,
  - qualification and assignment of personnel to operate ECS,
  - AND an ECS Emergency Communication System to get the word out.

Credit: Thinkstock 519706040

ECS for the Building's Egress Design

In addition, the building's egress design greatly affects the ECS design to fit with it.

- Richard W. Bukowski, P.E., FSFPE makes these ECS points in his article "EMERGENCY EGRESS STRATEGIES FOR BUILDINGS".
- After September 11, 2001, people are re-thinking egress strategies.
- Egress applies from small through large or tall buildings.
- Time is studied for egress.
- Egress includes corridors, elevators, refuge floors, stairs and exits to outside.
- The egress manager needs excellent two-way emergency communication with people in egress
- to know what is happening and to offer pertinent instructions.
- Exactly how the ECS shall be done depends on the building's egress plans.
- Both Egress and ECS are works in progress and need attention per project.
- You the Project Manager can initiate this discussion.

Credit: Thinkstock 200411107-001

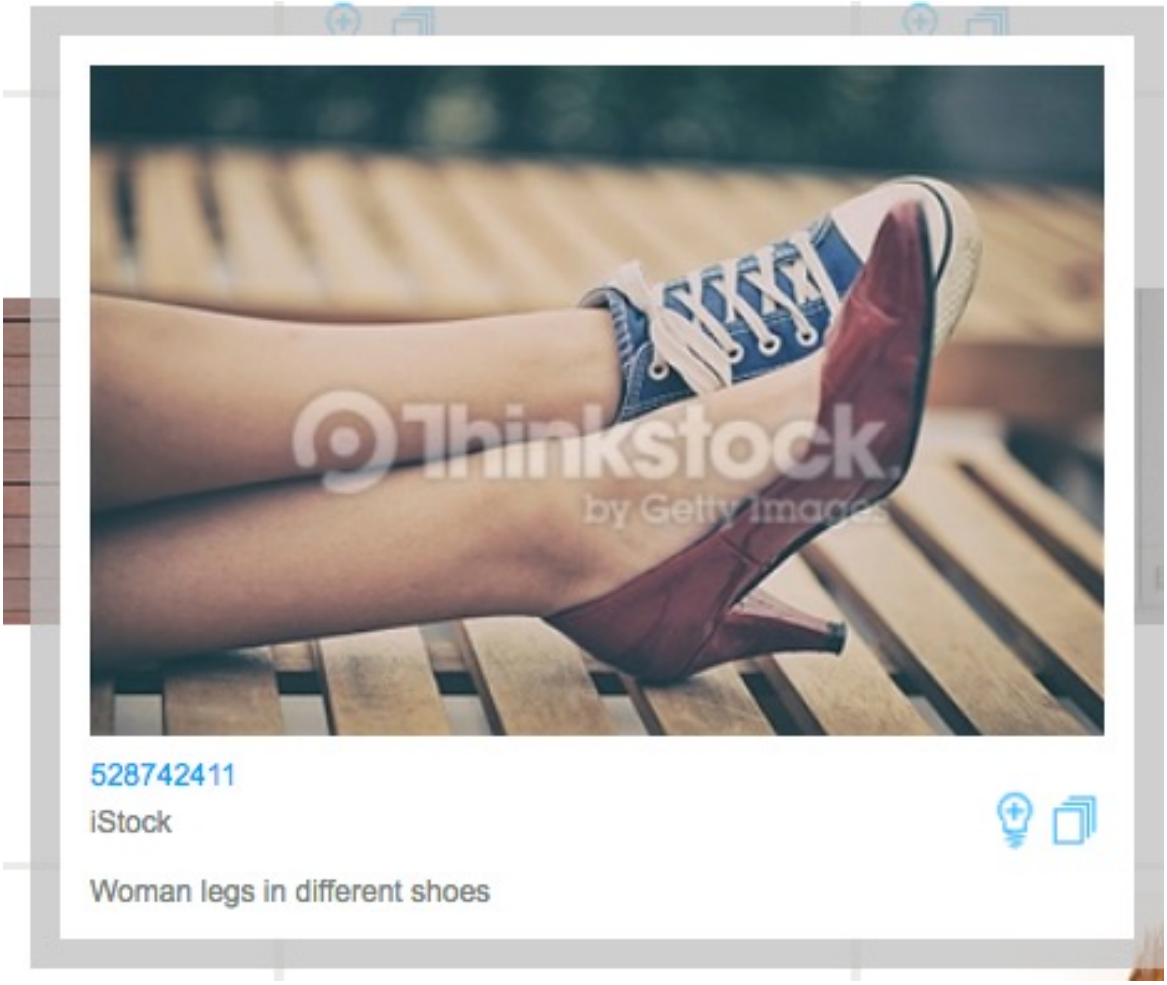
INTEGRATED SYSTEMS

- Integrated systems helped answer this firefighter question: "What can be remotely seen and heard from the area under alarm?"

Integrated Systems Are "A Work In Progress".

- After 911, Owners said "We gotta do Something! Let's integrate systems!"
- "Good, now we are on the same page." But are we?
- "Integration" is different to different to different people.
- First, we list some building systems, then show some "integration" concepts.
- WHAT MAKES GOOD SENSE TO INTEGRATE, and what is obviously not?
- You have buildings and systems experiences. So ask yourself.

Credit: Thinkstock 528742411

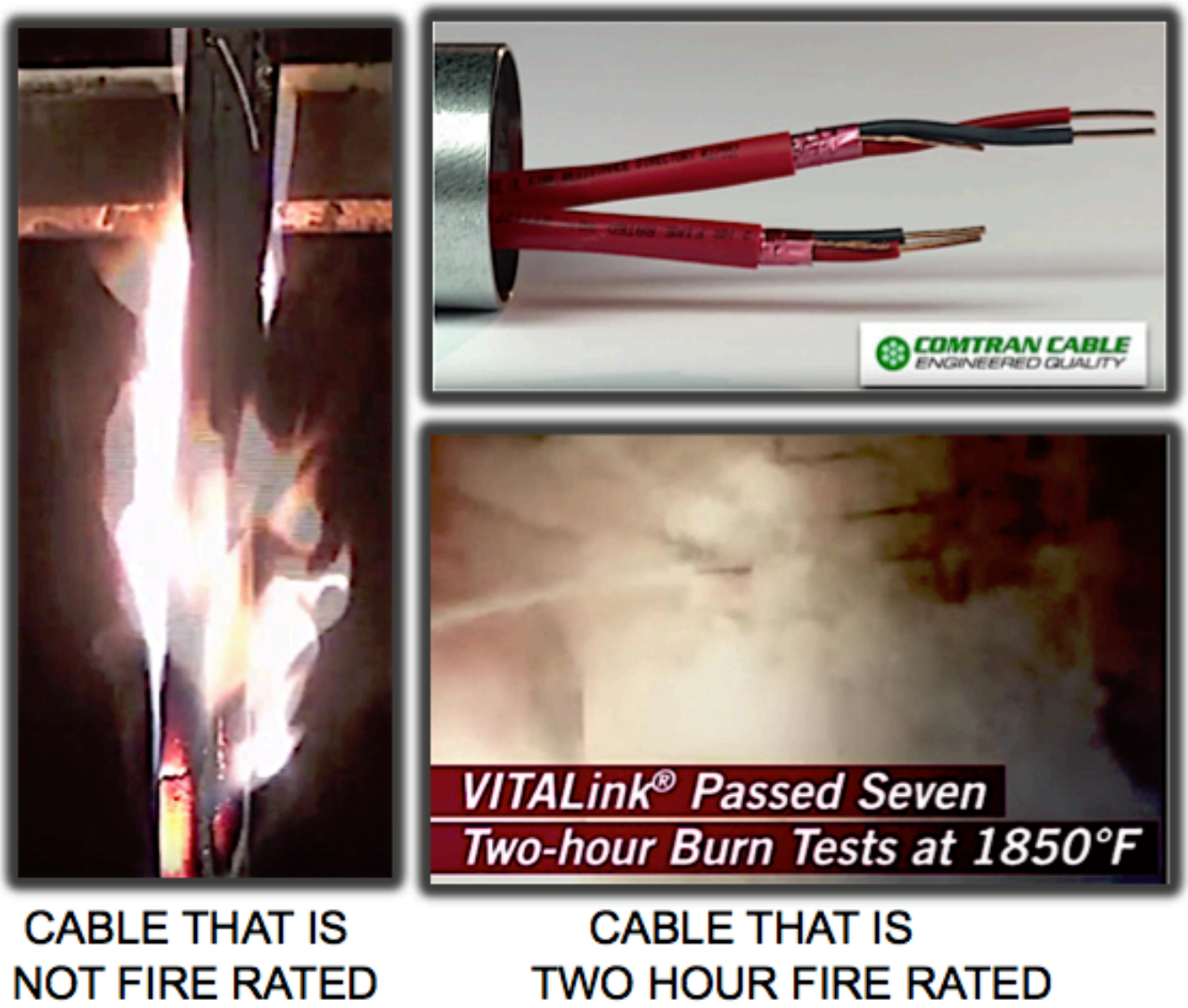


Fire Alarm Cable

- ALL SYSTEMS REQUIRE SOME CABLING. So Cabling is presented first.
- Some cables can burn. Code allows it for some situations.
- But code requires some cable situations to withstand two hours of fire.
- Two hour rated cable is termed “Circuit integrity” , CI or CIC cable.
- CIC applies to fire alarm, rescue, generator, and smoke removal, for examples.
- Project manager, where is it wise to apply CIC whether required or not?

Credit: Image is used by permission of Comtran Cable LLC.
Image in video <www.youtube.com/watch?v=O8rwKOXq2tE >, Dec. 2016.

Comtran, cables fire rated vs not fire rated.jpg



Some Safety Systems for Fire Alarm and Extinguishment Are >

1. Fire Alarm System
2. Security including CCTV, Intrusion Detection, and Access Control
3. Fire Protection Extinguishing systems whether
    a. water wet pipe,
    b. water dry pipe,
    c. or dry extinguishing

Credit: Thinkstock 477792101

Some Safety Systems for Rescue Are >

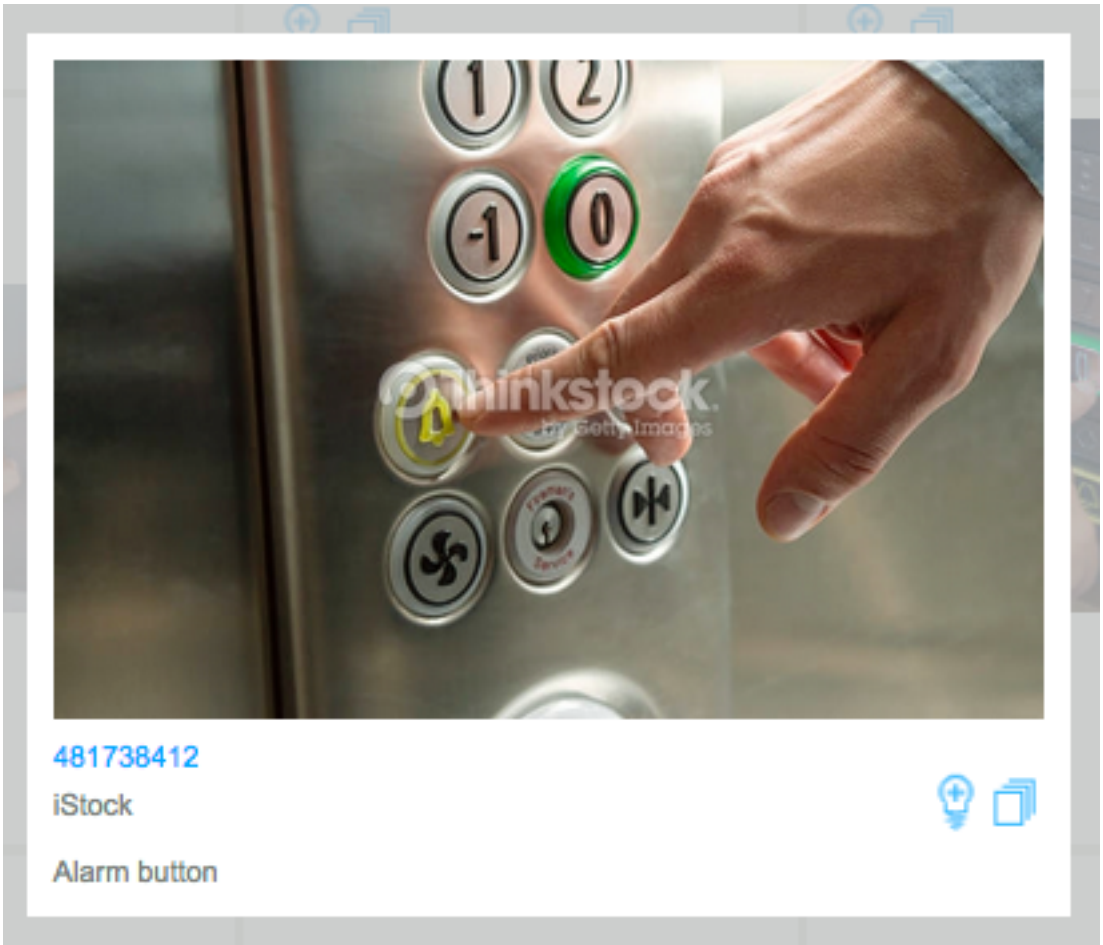
4. Local Network, Wide Area Network, Internet
5. Safe Area Intercom
6. Elevator intercom
7. Exit Wayfinding Speaker system
8. Emergency Communication System
9. Paging and Intercom (If qualified as part of ECS)
10. Mass Communication System
11. Nurse Call, Emergency Call & Door Monitoring

Credit: Thinkstock 494527221

Some More Safety Systems Are >

12. Hazard Detection such as refrigerant, methane, gas, radon, radiation
13. Elevator emergency control with recall and fire key functions
14. Emergency parts of other systems: Energy, HVAC, Lighting
15. Clocks, Watchman's Tour

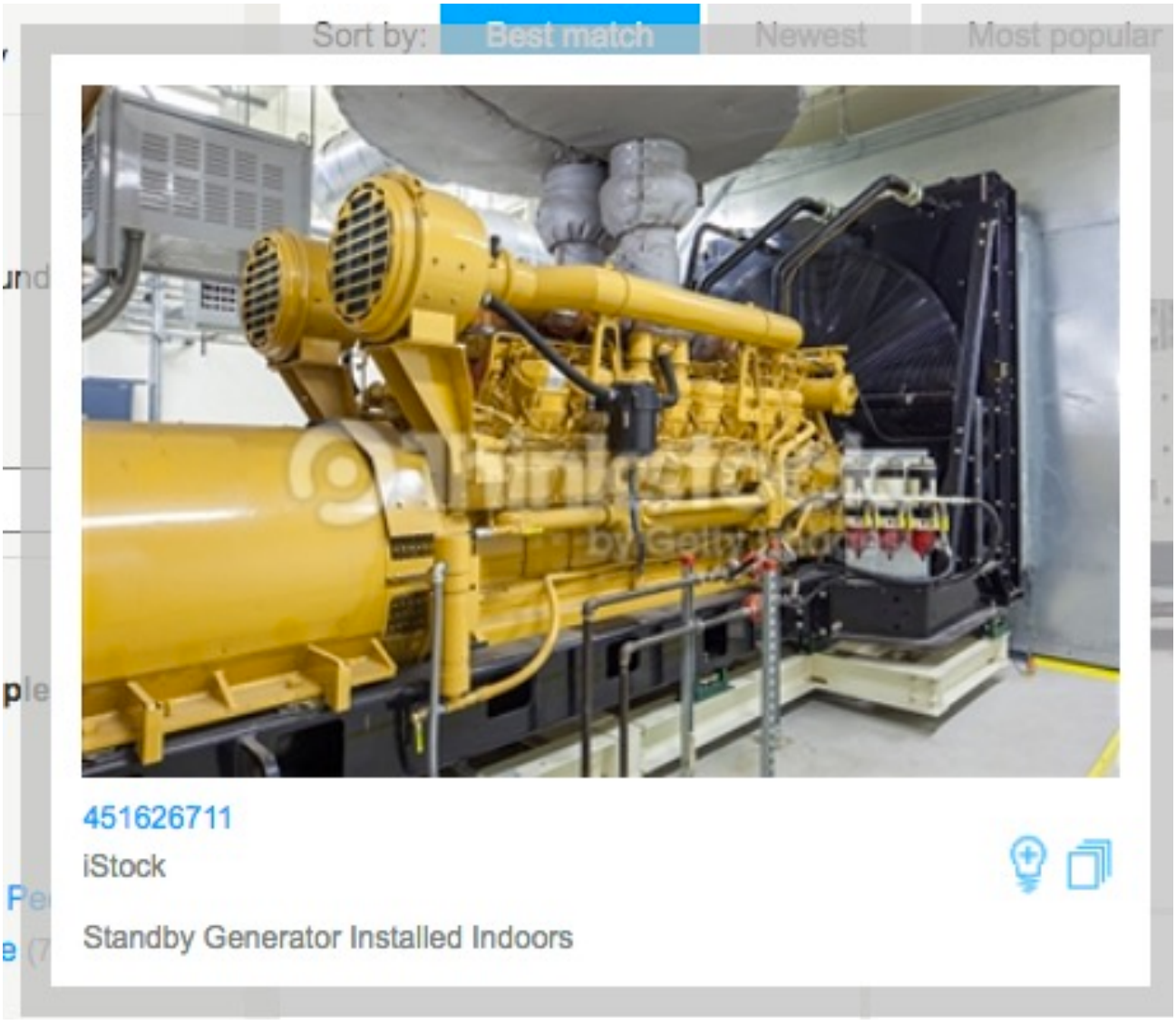
Credit: Thinkstock 481738412



Some Energy Systems Are >

16. Utility electric system
17. Emergency electric generation, whatever the source
18. Natural gas, propane gas, or liquid petroleum
19. Battery Backup Systems

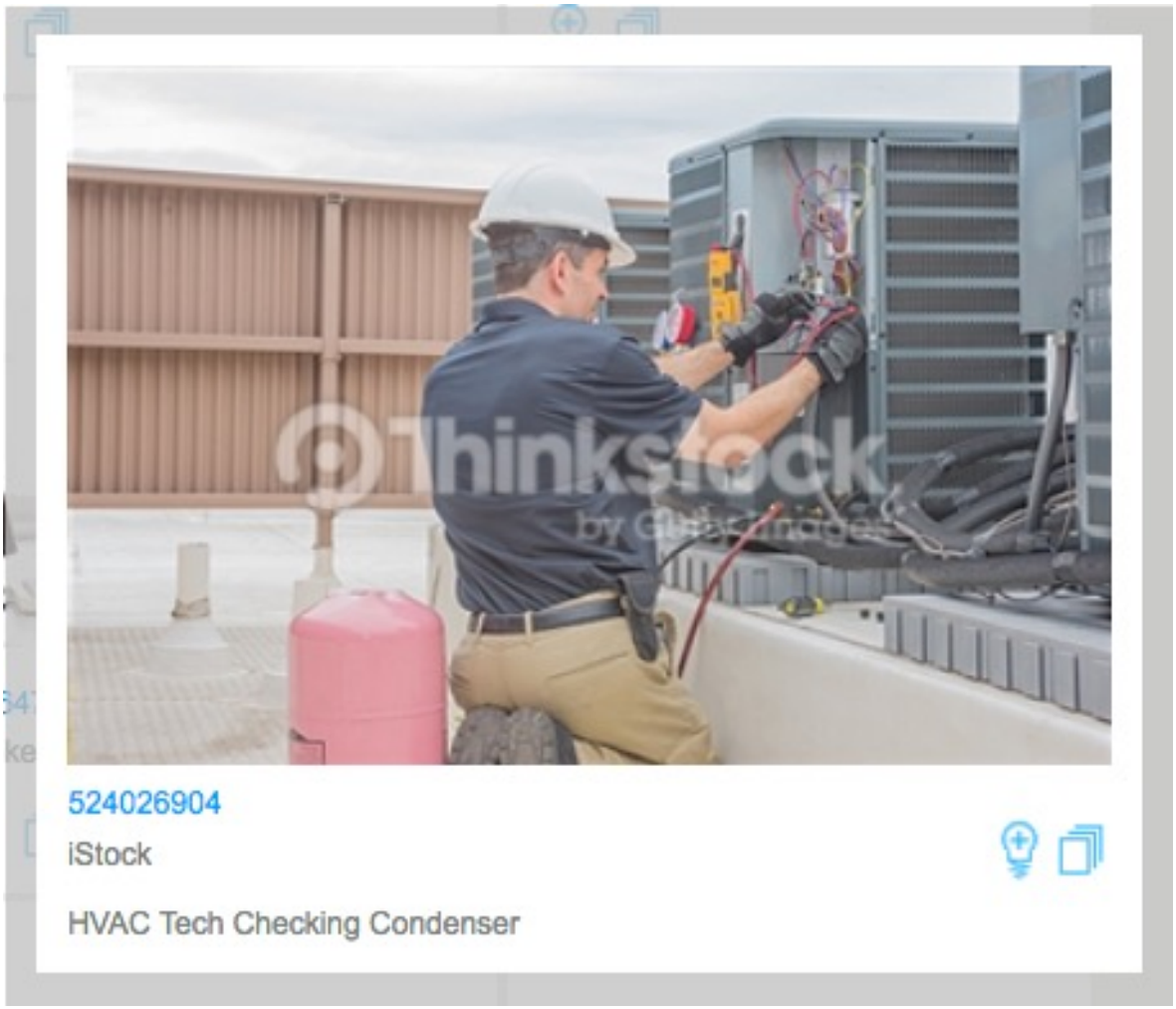
Credit: Thinkstock 451626711



Some Facility Function Systems Are >

20. HVAC has
    a. heating, ventilation, air conditioning,
    b. emergency smoke removal and sealed stair pressurization
21. Plumbing has
    c. potable water, cold and hot branches
    d. grey water, rain water, water storage and irrigation
22. Lighting control
23. Architectural shades, screens, partitions
24. Kitchen hoods and heat detectors
25. Laboratory systems
26. Lighting, Sound and Audio-visual for conference, class or auditorium
27. Voice and Data

Credit: Thinkstock 524026904



Some Production Systems Are >

28. Process control for manufacturing, warehousing, or water treatment
29. Office processes including Accounting, Inventory, Personnel
30. Kitchen and Dining systems
31. Nurse call system

This is the end of this systems list.

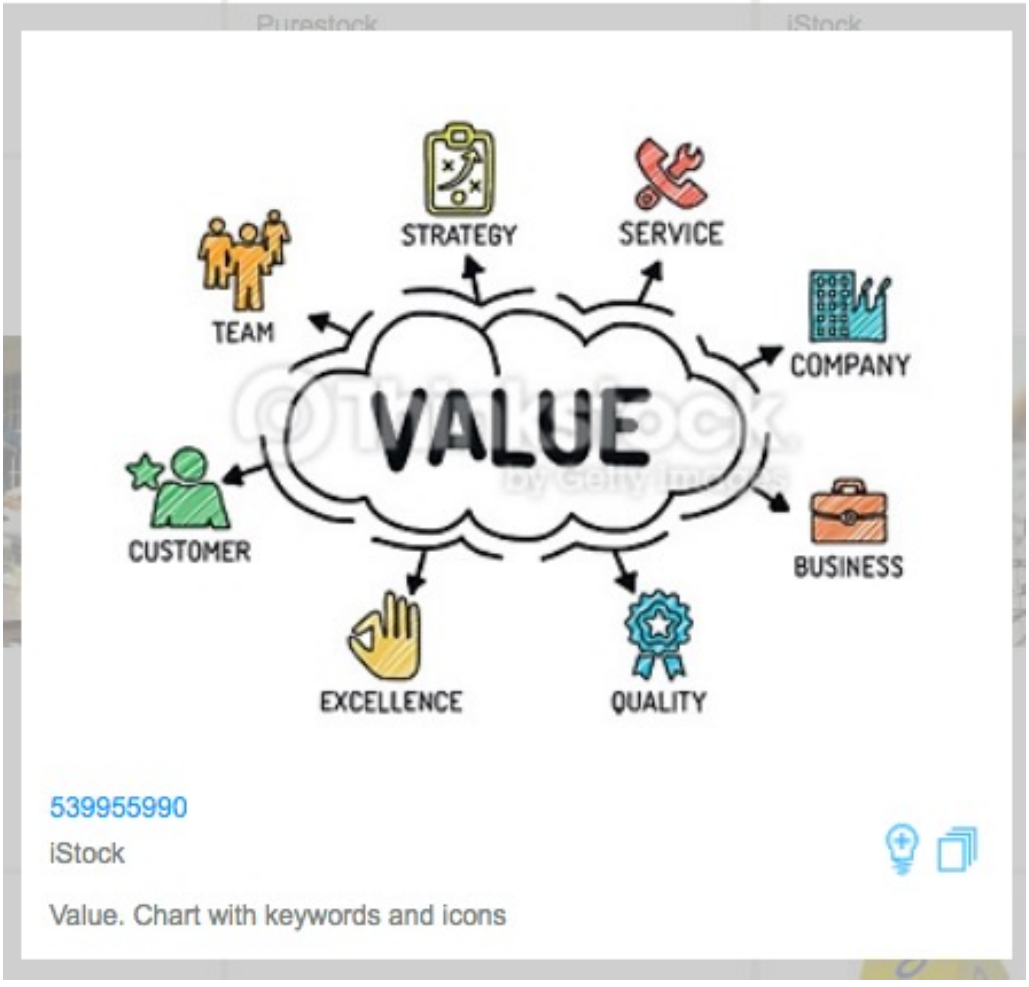
- Did you find some systems which might seem to work together? Why?
- Can you find some systems which you would say “No Way” to integration?
- Why not?
- Now that you are aware of systems, the Owner and the parties involved with design, construction and manufacturer should evaluate together what works best for the Owner’s situation.

Credit: Thinkstock 122423152

Integration Possibilities

- "Integrated Systems" become a profit center for engineers and contractors because
- Owners need help to research, design, install and maintain integrated systems.
- Homeland Security website offers an idea to help research Owner needs.
    - Integrated Rapid Visual Screening, IRVS, helps determine risk and resilience for buildings.
    - IRVS is based upon visual inspection.

Credit: Thinkstock 539955990



Building Management System

.

- The principle purpose of a Building Management System is to interface humans with multiple building systems.
- In the process, A BMS Building Management System might perform these services.
    - Collect information sent from other systems,
    - sort data,
    - select data,
    - display data,
    - and notify assigned persons.
- BMS might aim a camera at a nearby situation.
- The operator might read messages and view video to discern an action.
- The BMS and the operator can communicate through many systems.
- If BMS helps the operator do a good job, tenants might be pleased.
- A BMS can sort out and present information to help the Owner make decisions.

Credit: Thinkstock 837255770

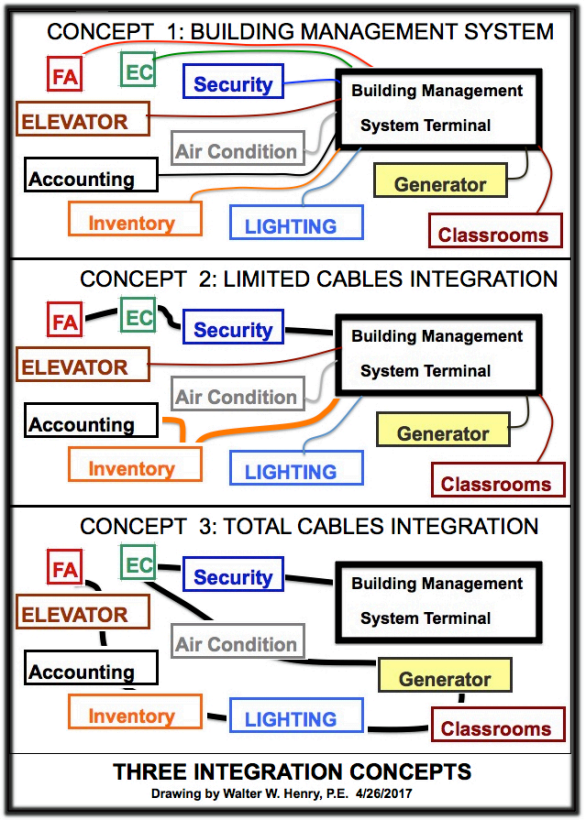
Concepts of Integration

- This Author observes three "integration" concepts.

1. CONCEPT 1: BUILDING MANAGEMENT SYSTEM
    a. Provide separate Fire Alarm, ECS, and Security systems as before.
    b. Gather "remote" indication or control at one BMS.
    c. Designers and Contractors immediately deployed this method.
2. CONCEPT 2: LIMITED SYSTEMS INTEGRATION
    a. Combine systems with similar and complementary purpose, testing and labeling.
    b. One example is Fire Alarm, ECS, and Security.
    c. After some adjustment of codes and equipment ratings, this method is sometimes used.
3. CONCEPT 3: TOTAL CABLES INTEGRATION
    a. What makes sense combined onto one cable?
    b. Some considerations are liability, function, insecurity, and "putting all the eggs into one basket", not just cost.

Credit: Graphic by Walter W. Henry, P.E., 2017

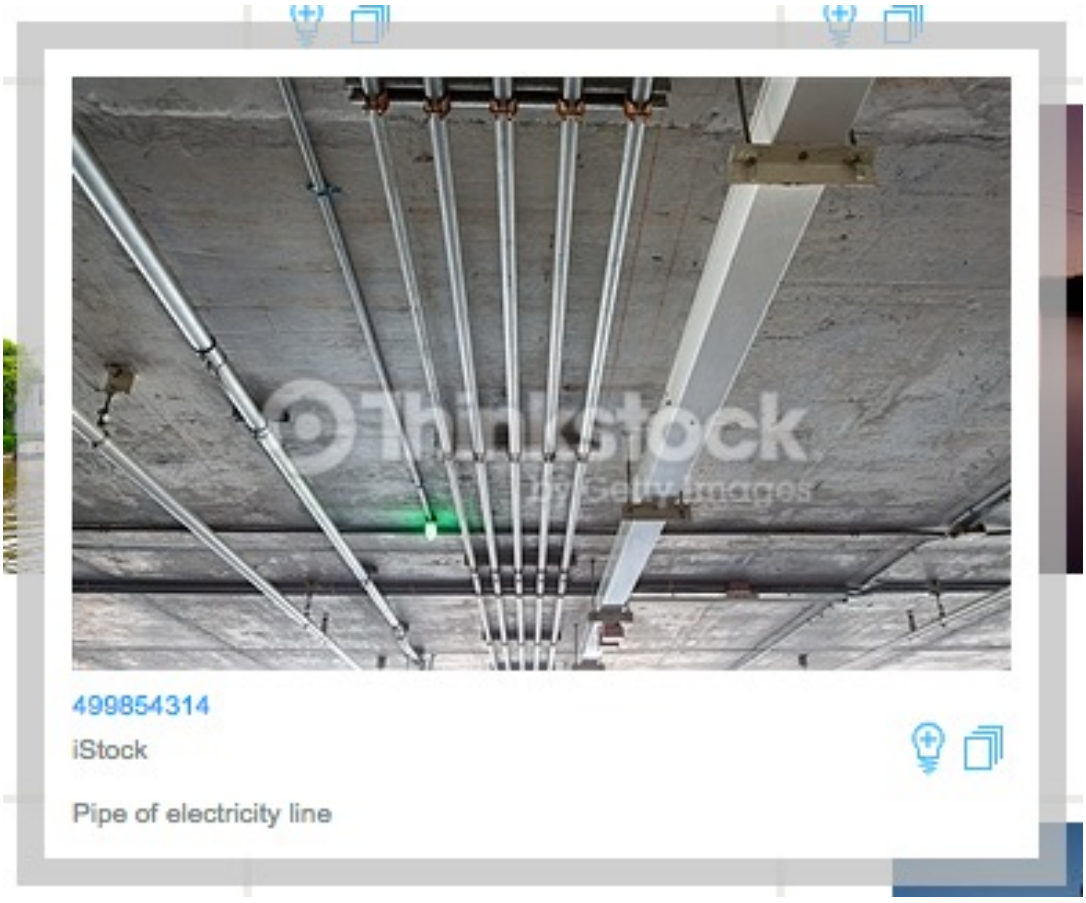
THREE INTEGRATION CONCEPTS.jpg



Sensible Cabling Consolidation

- Question: How extensive shall systems cabling consolidation be performed?
- Codes: Items on a cable shall conform with
  - the same applicable codes
  - and similar security level.
- Purpose: Items on a cable should have
  - similar overall function
  - and similar purpose.
- Failures: Separate cables per system
  - limits outages from one system's cable failure.
  - and generally isolates a system from problems of other systems.
- Security: Cables per system
  - reduces cyberthreat traveling among systems,
  - reduces entry to a system through access from a lower priory system.
  - and has multiple firewalls to be penetrated, not just one.
- Operation and Maintenance: Size and complication of the consolidated system
  - should create a workload that remains humanly manageable,
  - with training which can be learned for the multiple systems.

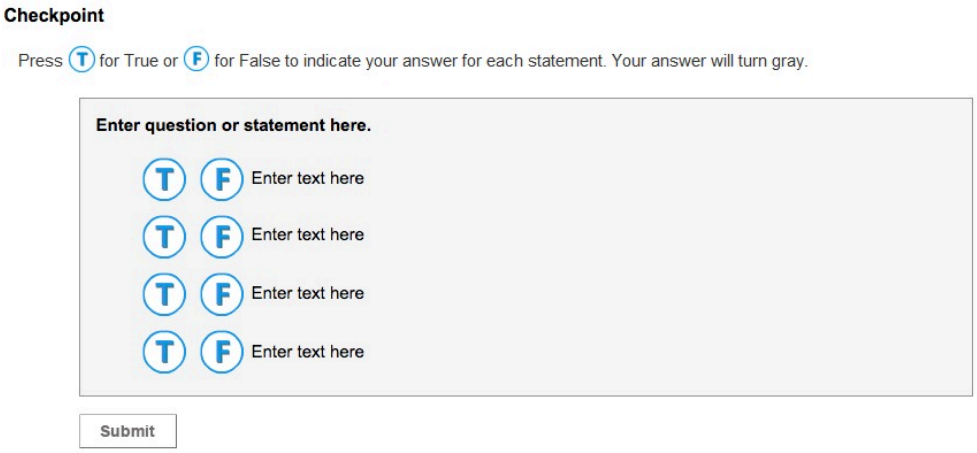
Credit: Thinkstock 499854314



ACTIVITY #3

True or False?

An ECS will have EVACs and may contain MNS, MCS, or both.
True.



HIGH RISE FIRE ALARM FEATURES

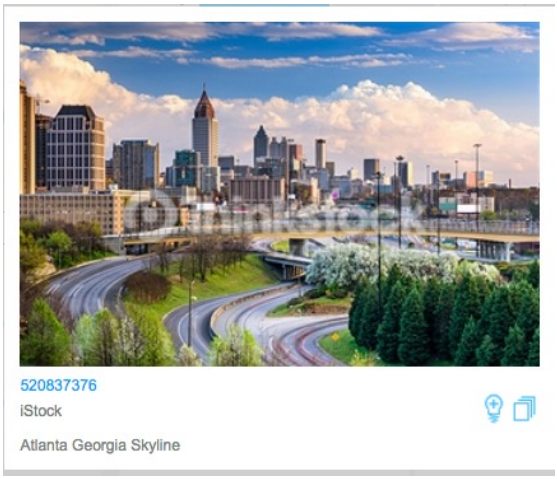
- Why should fire alarm systems be more elaborate in high-rise buildings than some other buildings? Compare high-rise to a smaller building.

- Emergency Communication is more difficult inside a high-rise building due to physical size and materials density. A High-Rise may contain some of these communication features.
    - Multiple riser cables and some circuit integrity cables help keep communications.
    - Multiple pre-recorded messages tailored to areas, live messages and optional "white noise or voice" guidance speakers assist evacuation, relocation, or other instructions to occupants.
    - Modern fire alarm speakers can contain especially good intelligibility.
    - Firefighter phones
    - In-building radio systems to relay signals of firefighters' radio messages.

- In a high-rise, people need more time and routes to move in, around, and out. Then the high-rise structure and systems need to protect egress routes for longer distance and time. Therefore a high-rise fire alarm system connects to multiple other building systems, complicating the systems.
    - Pressurization of stairwells, elevator shafts, and some egress routes.
    - HVAC damper control, smoke control, and door control.

- An Owner of a building which is not high rise may utilize some high-rise fire alarm features such as messaging as practical measures although not required by code.

Credit: Thinkstock 520837376



CYBERSECURITY

- Into the 1990s there was little or no internet.
- Local people respected the POTS to the fire department.
- Now “anyone ” might get their hands into your building system.
- Now that systems connect to the internet or WiFi, they are more vulnerable.
- This section outlines some wisdom from some IT professionals.

Credit: Thinkstock 517051620

What is a Cyberthreat?

- Cyber threats are DATA COMMUNICATION SITUATIONS which threaten harm to persons, purposes, organizations, data, or equipment.

- What Originates Cyberthreats?
  - environmental problems such as weather or natural disaster,
  - mechanical, electrical or chemical failure, whether deliberate or not;
  - OR UNAUTHORIZED ACCESS.

Credit: Thinkstock 517893152

Why Would Someone Want Unauthorized Access?

- DATA HAS VALUE,
  - whether monetary
  - or for plans and purposes.
- data is MULTIPLYING
- and systems are VULNERABLE.

Credit: Thinkstock 494940062

Why have Data Security?

- ""CARING" and "RISK" are the main reasons to Secure Data.
- . A cyber threat risks damage to
  - people, purposes, organizations,
  - systems, software, equipment or data.
- Cost is a reason to Secure Data.
  - A data breach may cost around a half million dollars.
  - Malicious cyber attacks cost American business over a half billion dollars a year.
- Regulation Compliance is intended to promote Caring by reducing Risk.

Credit: Thinkstock 512001652

CABA's Categories for Unauthorized Access

- CABA The Continental Automated Buildings Association categorizes three main cyberthreats.

1. "Infiltration" gains unauthorized access to a network
    a. then damages the network,
    b. or steals information,
    c. or both.

2. "Aggregation": an unauthorized user intercepts information in transit.
    a. Aggregation is also termed "man-in-the-middle attack".
    b. This interception is called "data harvesting".

3. "Exfiltration" is the removal of proprietary data from networks.

Credit: Thinkstock 175228583

What Are Routes for Unauthorized Access?

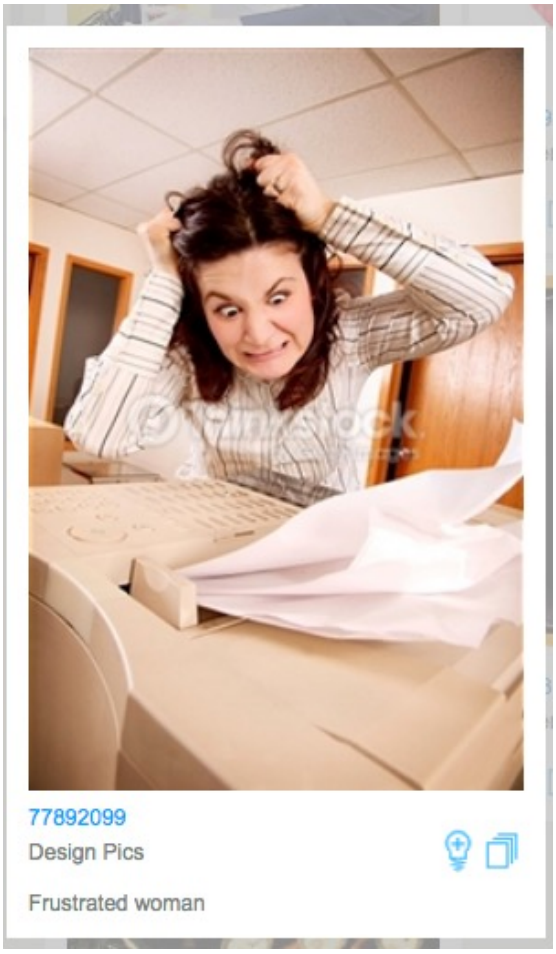
- IT Information Technology people fight on two fronts: internal and external.
- Half the IT people are more concerned about employees than hackers.

Credit: Thinkstock 452069551

Internal: Most Employee Leaks are Accident or Ignorance

- Employee ignorance, negligence or accident is larger than hacker risk.
- Printers and copiers need security, maintenance and rules since documents are
    - uncollected at the printout tray,
    - sent to wrong printer or wrong recipient,
    - or part of an unauthorized use.
- "The cloud" and so many internet connected devices complicate security.
- Employees load Social Security numbers or credit card information
    - to the cloud and accidentally share
    - or to portable storage that heygets misplaced.Internal: A Few Employee Leaks are on Purpose.
- About 12% of breaches are disgruntled employees selling information or helping hackers.
- Hackers want "P I I" Personally Identifiable Information for fraud.

Thinkstock 77892099



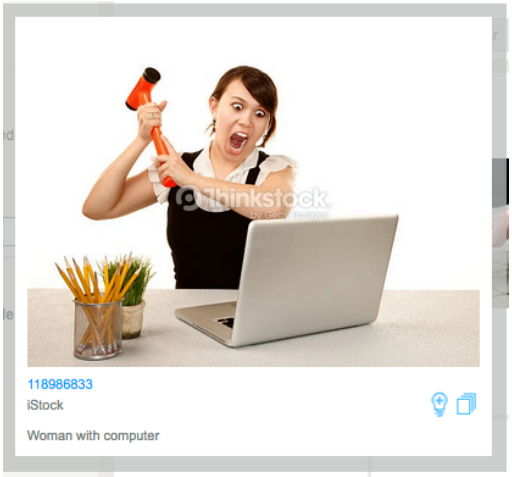
External Theft of Data

- Bot-network operators try to harm, control, or exploit another's systems.
- Some parties promote spam, spyware, malware or denial of service.
- Some work slowly over time using Advanced Persistent Threat.

Credit: Thinkstock 118986833 & 502615256

Producer, you may use two panels to show these two data&image groups.

118986833 Woman smashes computer



- Hacktivists may want attention for their cause.
- Hackers sometimes want a challenge for recognition, power, or profit.
- Phishers want to steal information, steal identities, or perform fraud, for profit.

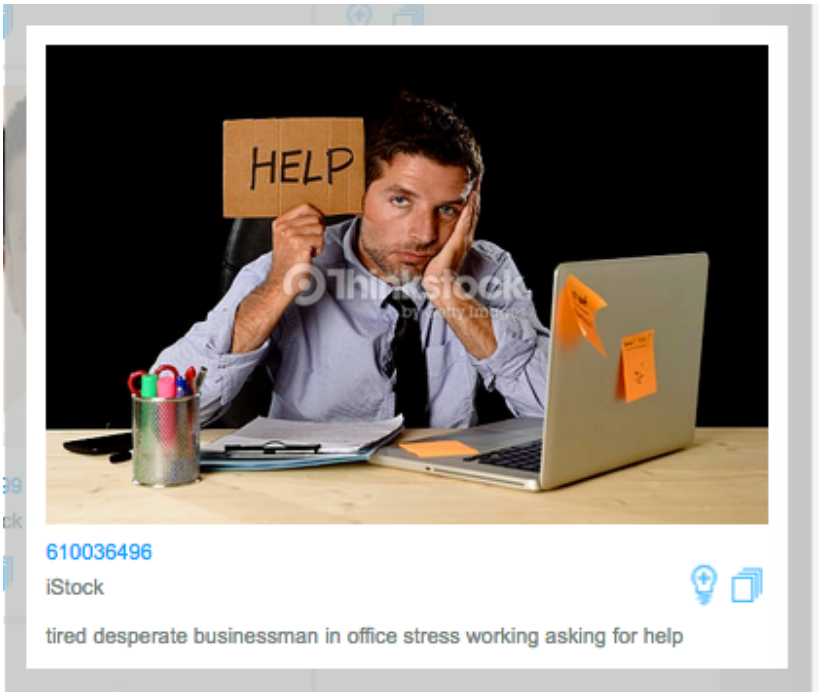
502615256 fisher

Why Be Pro-Active?

- Why is Cybercrime easier to perform than to remedy?
  - There are a lot of systems and data, and all need security.
  - A breach may take three months to uncover.
  - "The Internet of Things" multiplies potential access.
  - Many businesses have no response plan.

- As some results,
  - Perhaps a third of malicious breaches are found by accident.
  - Most large businesses are targeted, and that is increasing.
  - IT and security people wonder what they don't know.

Credit: Thinkstock 610036496



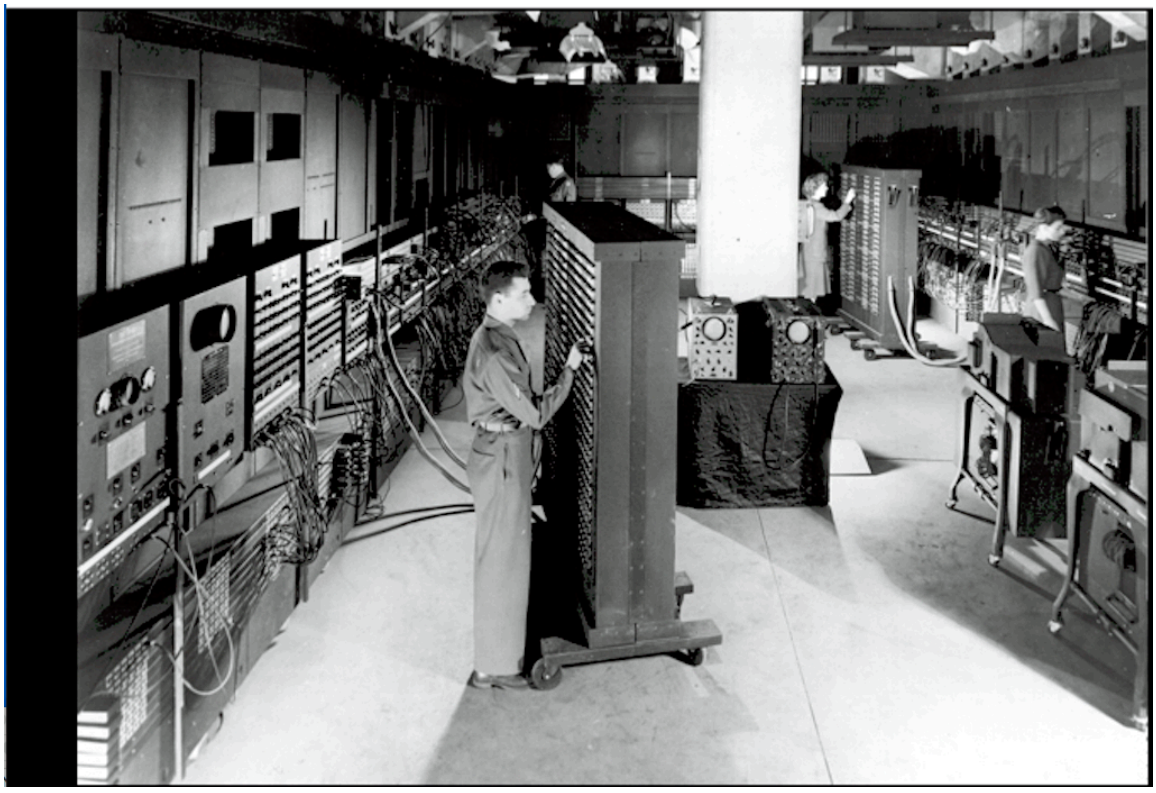
Why Are Ghost Assets a Problem?

- Ghost assets are equipments connected but out-of-service.
- Why re-purpose or remove Ghost assets?
    - Their information and communications may allow a security breach.
    - They cost power, space, insurance and tax.
    - They still cost upkeep, backup, storage, and support.
    - Licenses are still audited.
    - You will have less equipment to dust.

Although the 1946 ENIAC computer became a ghost asset, it was a wonder in its day. Grace Hopper invented the first compiler for a programming language. Women who programmed the 1946 ENIAC computer were
Kathleen McNulty Mauchly Antonelli, Jean Jennings Bartik, Frances Synder Holder, Marlyn Wescoff Meltzer, Frances Bilas Spence and Ruth Lichterman Teitelbaum.
In this photo, Corporal Irwin Goldstein and two of the programmer ladies manually sets electric switches and plug cables as in old-fashioned telephone switchboards.

Credit: U.S. Army Photo about 1946.

ENIAC 1946, at Moore School. U.S. Army Photo. public domain.jpg



Solution Ideas by ICS-CERT

4. ICS-CERT is the U.S. Department of Homeland Security, Industrial Control Systems Cyber Emergency Response Team.
5. Briefly, ICS-CERT works with government and private sectors to mitigate security incidents.
6. These parties must work together to mitigate security incidents.
    a. Facility Owner, Project Manager, Designer,
    b. Manufacturer, System Supplier, Installer,
    c. Maintenance and Security.
7. PREVENTION is the main goal. Prevent cyber threats or block their success.
8. CYBER-FORENSICS is secondary.
    a. Set-up systems to collect forensic incident information.
    b. Use forensic information to plan prevention.
9. Have the Manufacturer, and System Supplier include cyber-security in their proposed system, and have them explain it to the other parties, in advance of system purchase. Specify cyber-security and its testing. Test it.

Credit: Thinkstock 122584647

Five Key Security Countermeasures

- ICS-CERT "Five Key Security Countermeasures for Industrial Control Systems"
- suggests these measures an Owner can take for a stronger security environment and reduced risk to systems.

1. Plan and train each person regarding their privilege and limit, and enforce it.
2. Identify, minimize, and secure network connections to the system.
3. Assess risk and thoroughly defend the systems and networks.
4. Constantly watch and assess the security of systems, networks, and interconnections.
5. Harden the systems.
    a. Disable unnecessary services, ports, and protocols;
    b. Utilize the most modern security features (Next Generation FireWall)
    c. Remove out-of-service equipment, programs and connections.
    d. Then CONSTANTLY MANAGE the system.

These have been some abbreviated thoughts. Cyber security is a significant study of it's own.

Credit: Thinkstock 489779000

Wireless

- Building systems now offer wireless sensors and controls.
- Examples include HVAC, lighting, plumbing, fire alarm, and security.
- Quantity multiplies: each building system having wireless can have scores or hundreds of signals.
- Electromagnetic smog from many sources is a real health concern now.
- Wireless affects everyone. With some, EMS is obvious more than with others.
- Wireless can be intercepted and hacked. Is it encrypted, or well enough?
- If devices are hardwired where possible, it helps health and security.

Credit: Thinkstock 664871414

INTERNET PRIVACY

- Cyber Privacy should be the secrecy of information between a sender and receiver of information over the internet.
- "Information" includes the sender, receiver, timing, sites visited, and transmitted data.
- Some online companies and others have the technical capability to collect, organize, identify and share information for commercial or other purposes.

Here are some questions.

- When as fire alarm, security, HVAC or other systems notify selected persons about events, how are individuals, Owners, systems and information protected from attacks or spreading of information?

Credit: Thinkstock 504018046

(Internet Privacy questions, continued)

- Does the internet provider have a right to browsing history or other data by employees
    - about people notified by employees,
    - or about people contacting the employees or building systems,
    - or about maintenance people browsing for instructions and machine parts?
- How can data profiling affect the building systems, employees or Owner?
- Will the internet cache and history be cleared regularly and often?
- Are passwords strong?
- Do building systems protect against virus, malware, spam, phishing, pharming, and spyware?
- Is anyone overstepping bounds in the information they request?
- How will data be used?
- How does one make the many online devices to be private?

Credit: Thinkstock 512328734

CARBON MONOXIDE DETECTION

- Carbon monoxide can build up where there are
  - Crowds of people, schools, water heaters, stoves,
  - Fuel oil operated machinery, gas furnaces or space heaters,
- 70 ppm can cause headaches, fatigue, and nausea.
- 150 ppm can cause disorientation, unconsciousness, or death.
- CO detectors can report through a fire alarm or a security system.
- NFPA 720 requires CO detection and sounders with T4 tone pattern in
  - hotel and motel guest rooms,
  - college and university dormitories,
  - and assisted living facilities.

Credit: Thinkstock 645462774

WHERE ARE THEY NOW?

During the 1970's into the 2000's, fire alarm companies changed hands. So, where are they now? This chart demonstrates a previously mentioned trend. Some larger companies integrate systems by acquiring other companies. However some companies remain on their own.

These are some systems being collected.

- fire alarm, emergency communication, mass notification,
- security, access control, CCTV, intrusion detection,
- and sprinkler fire protection.

This chart focuses on some fire alarm companies.

Credit: Graphic by Walter W. Henry, P.E., 2017

Where Are They Now.jpg

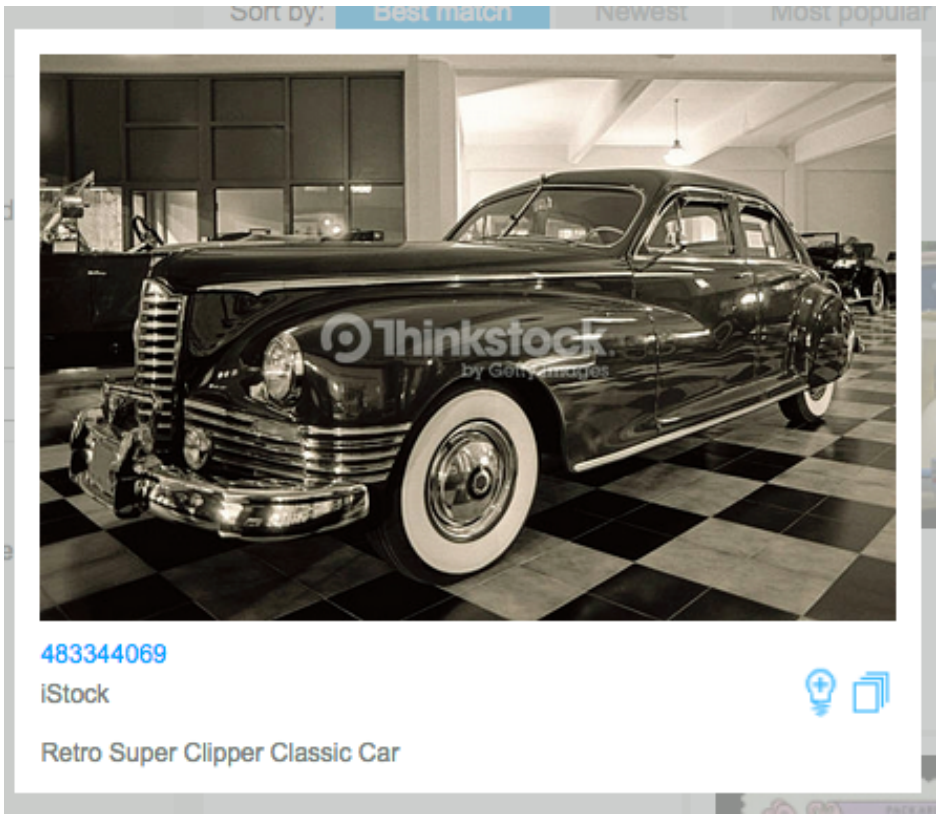
Where Are They Now?		
List by this Author, Walter W. Henry, P.E. , May 2017		
(Parentheses indicate a company absorbed with it's name out of service)		
These are some names in this Author's experience. There are other good names also.		
Initially	*Date*	*as of May 2017, part of*
Cooper, Menvier and JSB brands		Eaton Life Safety
Wheelock		Eaton Life Safety
Federal Signal		Federal Signal
Fike Fire Protection		Fike Fire Protection
GENTEX		GENTEX
Pittway > Allied Signal	2000	Honeywell Life Safety Group
FCI > Fire Control Instruments	2000	Honeywell Life Safety Group
Fire-Lite Alarms		Honeywell Life Safety Group
Gamewell	2003	Honeywell Life Safety Group
Notifier	1999	Honeywell Life Safety Group
Silent Knight		Honeywell Life Safety Group
FCI > Pittway > System Sensor		Honeywell Life Safety Group
Tyco Simplex Grinnell	2001	Tyco
Simplex-Grinnell (Autocall)	2016	Johnson Controls International
Tyco Fire Protection Products	2016	Johnson Controls International
Harrington Fire	2015	Potter Electric Signal Company
Mircom, Secutron, Signalink	1973-	MGC (Mircom Group of Companies)
Cerberus(Pyrotronics)	1998	Siemens A.G.
Faraday (Standard Electric Time Company)	1998	Siemens A.G.
Siemens Fire Products and Systems		Siemens A.G.
Edwards Signaling (Kalatel + Sentrol)	2010	UTC Building & Industrial Systems
Kidde	2005	UTC Building & Industrial Systems

SOME DESIGN PRINCIPLES

True Economy Often Buys a New Quality System.

- "Quality is remembered long after price is forgotten." The photo is a 1946 Packard Super Clipper.
- If the existing system is practically new, meets new requirements, and can expand, consider re-use. Otherwise, consider a new system.
- Specify 10% more quality having say 30% more lifespan and 30% less repair.
- Buy a quality new system to get the most Value related to the Cost.
    - Acquire a new lifespan
    - Acquire a one year warrantee on everything, without finger-pointing at old "repaired" or patched-on systems.
    - Receive maintenance labor and parts lower in quantity and price.
    - Fit with the new ECS, MNS, and cybersecurity.
    - Fit the latest building configuration.
    - Conform with ADA and Owner special needs such as JHACO.

Credit: Thinkstock 483344069 Packard Super Clipper



True Economy Hires a Qualified System Designer.

- Acquire a qualified NICET Level 4 designer or a qualified fire alarm engineer.
    - Study the existing system, present the Owner with approaches, and compare Cost versus Value.
    - Coordinate with the Owner needs, applicable codes, power supply, smoke control, fire suppression, elevators, and HVAC.
    - Present the NICET Level 3, 2, and 1 installers with complete documents ready to bid “apples for apples” and install one time.
- Which picture might be a qualified fire alarm system designer?

Credit: Thinkstock 78461061

True Economy Buys It While It's a Bid Bargain.

- Buy 25% surplus capacity and 25% spare parts while you have a bid bargain.
- Bids should fall in a close range. If a bid is out of range, low or high, check into it. You don't want to put a contractor out-of-business for missing something. And you don't want an underbidding Change Order specialist.
- Budget some funds to cover change orders because they DO occur for good causes.

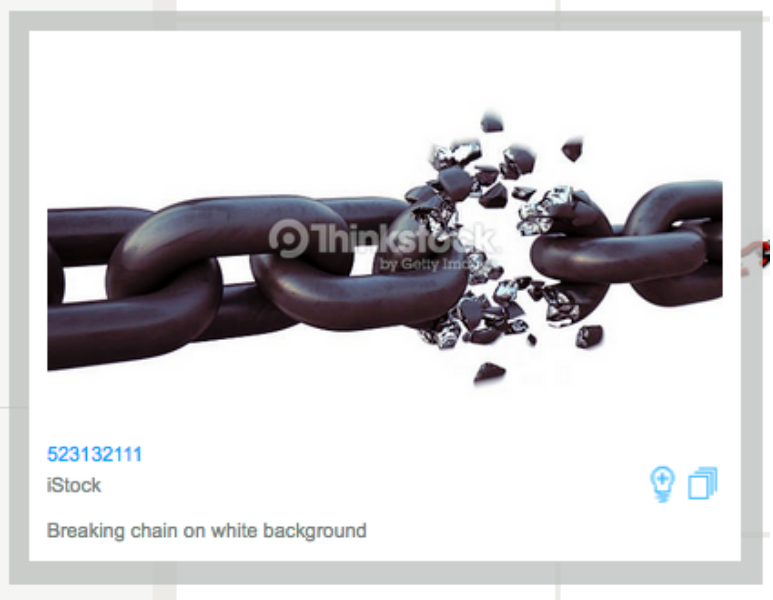
Credit: photo by Walter W. Henry, P.E., 2017

IMG_3252 2017_05_17 Ladder Truck.jpg

Keep It Simple.

- Simple survives stronger .
- Ask “What are the weak links that could shut down this system?” For example, you buy a bedside clock because you like it. Then one lousy switch crunches to a stop and you can’t fix it.
- Inspect for simple surprises. For example, a woman purchased some beautiful new slide-on shoes whose footbed ridge gouged her foot.
- A quality machine is no better than maintenance. Specify manufacturers whose local suppliers provide good maintenance. For example, maintenance is one reason that this Author has not yet purchased a new Lamborghini.

Credit: Thinkstock 523132111



Plan for the Worst and Work for the Best.

- Design for function under bad conditions. That may cover most disasters. But a building wiped away may still put the systems "out of business."
- Put the big rocks in the jar then fill in with the little ones. Big rocks are big cost and big significance. You are successful if Addenda and Changes deal with little rocks instead of big rocks.
- Design against the 10% of problems that occur 90% of the time.
    - For example, in Southeast Georgia, one project's transformer and generator were about 6 inches higher than water level in a nearby a storm and tidal swamp. This Engineer specified 18 inch tall pads for transformer, generator and everything in the main switchboard room. He designed the main communication rooms to locate on second floor.
    - For another example, purchase a $100 battery backup to stop the power blinks that kill your computer equipment.
- Include local controls to operate the equipment if remote controls fail.

Credit: Thinkstock 164107213

164107213
iStock

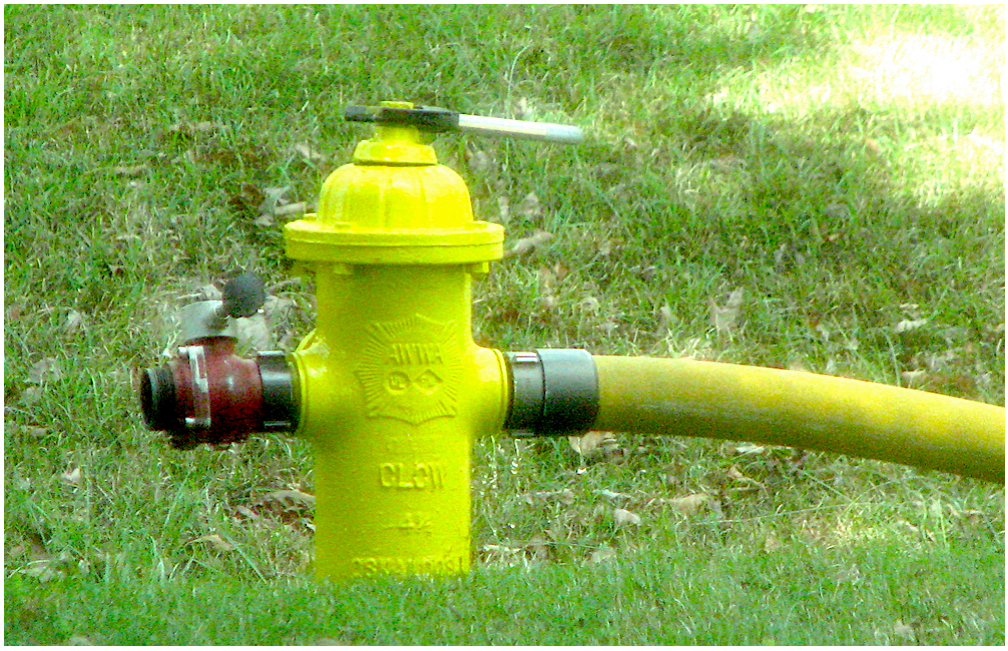
Jar of rocks

Ask “Does This Design Work Well for People?”

- Plan how the installer shall work around occupants.
- Design to fit codes, good practice, other design disciplines, and Owner needs.
- Imagine ones self in the building, utilizing the system. Visualize it. Does it work well? Does your subconcious tell you that it feels right?
- From start of design through post-final inspections, pray for everyone and everything involved in this Work.
- Then quit designing and issue the Contract Documents for bid.

Credit: photo by Walter W. Henry, P.E., 2017

IMG_3222 2017_05_17 2000's fire hydrant .jpg



Test To Prove that System Performs per Contract Documents.

An Engineer specified a quality fire alarm system. During final inspection, it was discovered that strobes in a corridor barely flashed. The Contractor discovered a deficient strobe power supply and replaced it. This experience demonstrates these things.

- If you want to know, you have to go. GO see it, hear it, smell it, and touch it. Observe and test a system 100 percent, or as close as possible. Statistical methods do NOT find defects or prove a system. When the chips are down, you want EVERYTHING to work!

- A well written Contract Document details that the system WILL be 100% tested, the Contractor and helpers to be present, minimum tools required, What and How to observe, and test procedure. Then the Contractors bid it, expect it, and make it come to pass. Since it's in scope and they get paid, they're happy.

- It is urgent and important for the Owner to fund adequate days of testing to accomplish a 100% test. This test is where the rubber meets the road. Owners and Project Managers, DO NOT SKIMP! b It is NOW that you insist upon 100% conformance to Contract Documents, in advance of building occupancy, and before every team disbands and leaves.

Credit: Thinkstock 615980982 & 687988990

A Fire Alarm Test Discovered a Deficient Strobe Power Supply.

- Inspect that you get what you specified and that it works as specified.
- This video demonstrates a fire alarm test, a fire alarm strobe flashing, and a slow whoop sound. The observer might ask why the strobe seems to have intermittent flashes.

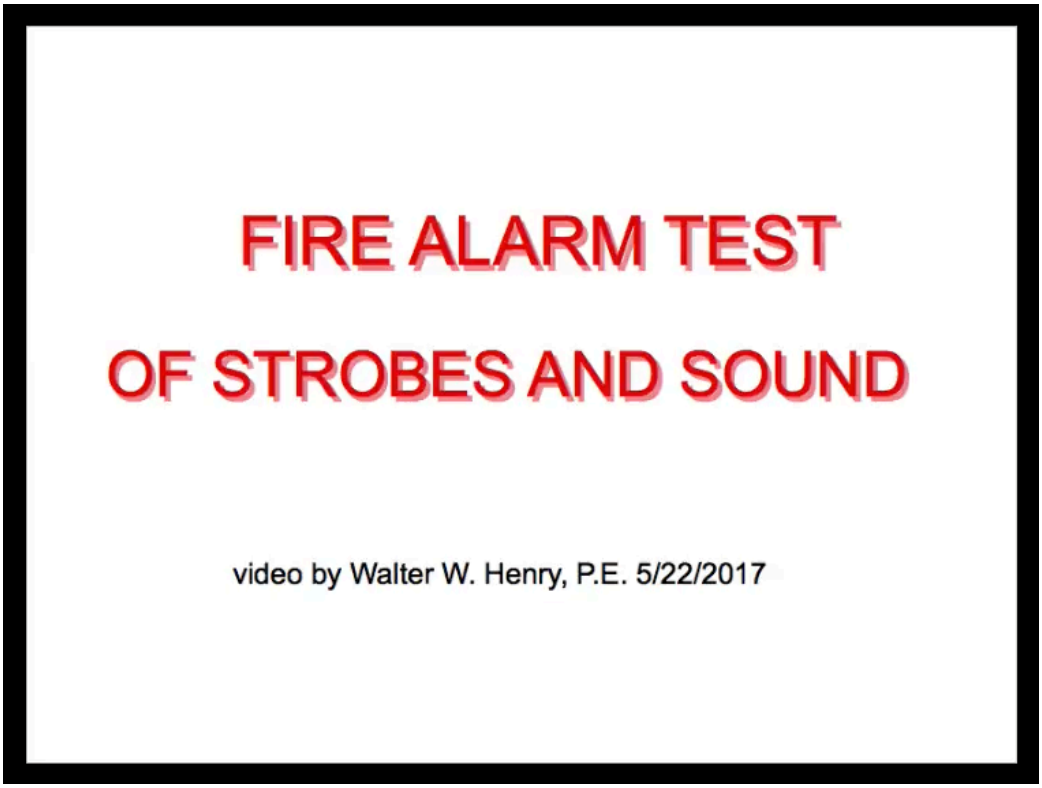
Credit: Video by Walter W. Henry, P.E. 2017

Presenter, if you need to show something on screen until the video, show this.)

Strobe & Sound Test, MVI_2232 edited, OPENING PANEL.JPG

Strobe & Sound Test, MVI_2232 edited.mp4

(



LEED, Leadership in Energy and Environmental Design

- Green Build programs offer Owner education and building rating incentives.
- United States Green Build Council's LEED offers no credits for Fire Alarm or ECS at this time.
- However, LEED expresses the following goals, which have been the same goals of Fire Alarm and ECS systems all along.
    - Prolong the lifespan of the facility.
    - Conserve resources.
    - Help protect the wellbeing and comfort of occupants.
    - And help protect the wellbeing of the environment and habitat.

Credit: photo by Walter W. Henry, P.E., 2017

IMG_3248 2017_04_07 firefighter setup.jpg

Which Type of Fire Alarm System Fits The Project?

- A “Relay” type system might apply to a small facility where zoning would be sufficient.
- An “Addressable” type system applies to most buildings, and definitely applies to larger facilities and high-rise buildings.
- Integrated Systems apply to some larger buildings, campuses or multiple facilities. These Owners usually have 24/7/365 monitoring personnel.

Credit: Thinkstock 179053527 small, 149060668 medium, 517282994 large buildings

179053527 small 149060668 medium 517282994 large buildings

179053527
iStock

149060668
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517282994
iStock

ACTIVITY #4

Producer, this is correct sequence. Mix it up please.

Place these systems into their sequence of development.

1 Coded Box

2 Conventional (Relay)

3 Addressable

4 Integrated

Activity:

Enter question or statement here.

Place the numbers in the correct sequence.

1		Item
2		Item
3		Item
4		Item
5		Item

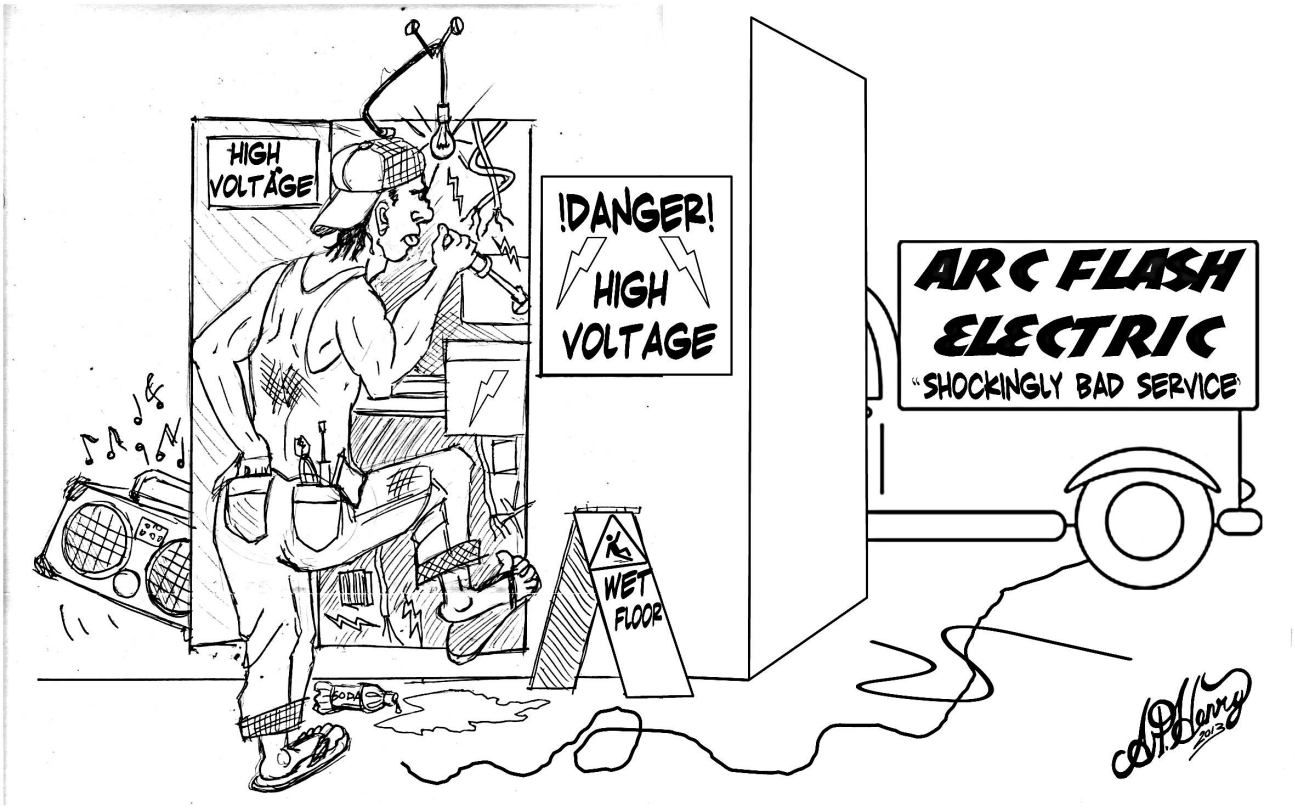
If you can show an image, show
Credit: Thinkstock 122568196

Electrical Work Safety

NFPA 70E presents "Electrical Safety in the Workplace". Here is a lighthearted question. What is RIGHT about this picture?

(This is not part of your final quiz).

You get the general idea.



CONCLUSION

The Big Picture Affects Comprehension and Response

- Since year 2000, fire alarm, emergency communications and security have added system integration, high speed data and cybersecurity. Together their scope has burgeoned. The big picture is almost bewildering. But the big picture helps us comprehend how these specialties synergize.
- A big picture helps Owners, financiers, occupants, and "the public" appreciate the blessings which we bring them. Fire alarm, ECS and security systems help responders provide better life, health, safety, protection, joy and peace for innumerable individuals and their familes and friends.
- Image shows a Benjamin Industrial Signal N8546 Vibrahorn.

Credit: Benjamin Industrial Signal N8546 Vibrahorn image is used by permission of eBay seller PineHog, 2017

Benjamin Vibrahorn by PineHog, 2017.jpg

The Big Picture Affects Our Creativity

- The big picture helps us create. We humans are specially gifted with capability to create. We feel, imagine, and visualize. We express it with spoken and written words. Then we physically build the words into existence.
- It is economic necessity to get the job done, get paid and move on. But when we design to bless people, we make decisions which are better for all concerned.
- Our predecessors set landmarks regarding fire alarm, emergency communication and security. As we appreciate their benefits to us, we protect, enjoy and enhance those blessings to others.

This Author hopes that you enjoyed this presentation and benefit from it.

Credit: photo by Walter W. Henry, P.E., 2004

MCCG Chapel window.jpg

AUTHOR BIOGRAPHY

Walter W. Henry, P.E., LEED™ AP, BD&C
Mr. Henry acquired a Bachelor of Science in Electrical Engineering degree from LeTourneau College, Texas during 1973. In the Georgia Air National Guard he learned to think-through electronics as a flight facilities technician for six years. He became a registered professional Engineer in Georgia during 1983 and a LEED Approved Professional during 2009.

Owners want facilities that "work right". Contractors said that they liked Mr. Henry's drawings and specifications because "everything" was there. To verify that installations contained the specified material and function, Mr. Henry performed progress and final site observations.

Mr. Henry designed facilities from residences to high-rise, environmental to hospital, and education to government. Facilities contained multiple systems such as fire alarm, lighting, power distribution, generators, grounding, surge suppression, and lightning protection.

