# CREW
# RESOURCE MANAGEMENT

*A force multiplier for better critical fire service decision making*





**Proudly revised through the cooperation of the National Fallen Firefighters Foundation and Milliken & Company.**

# Acknowledgements & Fire Service History of CRM

Crew Resource Management (CRM) is the effective use of all resources to:

- minimize errors
- improve safety
- improve supervisor decision making, and
- improve overall team performance.

It is considered a powerful "force multiplier" with a proven record (40+ years) of improving safety performance in high risk environments. To that end it is only fitting that the ideology of CRM was used to assemble this training manual. The following people contributed time, talent, and funds to developing this work.

Garry L. Briese, CAE, Executive Director of the IAFC was the determined visionary for the origin of this work. He embarked on the journey to bring it to fruition in 1999. In his usual fashion, Garry took a small spark, turned it into a glowing ember, and through vision and effort ignited what is continuing to be an increased discovery and adoption of a proven concept for better decision making and teamwork in the fire service. This fourth edition of the CRM manual reflects a continued commitment by the IAFC and its Safety, Health and Survival Section to champion the value of CRM as a means to reduce error, effectively identify risk and manage work environments with that have high potential for injury and death. Successfully employed in a multitude of fire departments and other high-risk occupations for more than two decades, and steeped in "common sense," CRM is a natural fit for the fire and emergency service. The following recognizes the original financial supporters of introducing CRM to the fire service and the members of the inaugural task force assembled to guide the creation of this primer.

## Financial Support

The late Dennis Smith, author of *Report from Engine Co. 82*, *Report from Ground Zero* and prominent leader in a number of charitable organizations, contributed the seed money to set the wheels in motion to produce the first edition of this manual in 2000.

**The original *Crew Resource Management* guide was developed through generous assistance from the Foundation for Firefighter Health and Safety, Volunteer Fireman's Insurance Services and the U.S. Fire Administration.**

Chief Kenneth O. Burris, former Chief Operating Officer of the U.S. Fire Administration, approved grant funds and lent his experience and position to support the inaugural introduction of this project.

Michael Young and Lee Bainbridge, Volunteer Fireman's Insurance Services, provided additional funding for the first generation of the project.

Milliken and Company provided generous funding for the 2024 update to this manual.

## A Unique Perspective & Beyond

The Campbell County (WY) Fire Department had already been using CRM for several years when they were invited to the inaugural gathering in Fairfax (VA) to study the applicability of CRM to the fire service. Former Training Officer Randy Okray, Firefighter Thomas Lubnau II, and then Training Officer Jeff Wagoner shared their department's experience with CRM and provided a distinctive insight into transferring CRM from the aviation world to the fire service world. Their perspective was turned into one of the premier fire service works on the subject.

That first meeting at IAFC Headquarters in Fairfax gave rise to the production of this primer and other training programs that crisscrossed the country. Departments that embraced the principles experienced a renaissance in leadership that made them stronger and better performing organizations. Through the ensuing twenty-four years, believers in the concepts have continued to espouse the benefits of the program, keeping the vision of the original cohort alive and proving CRM is a force multiplier.


CREDIT: FOUNTAIN HILLS (AZ) FIRE DEPARTMENT

# The Original Cohort

A diverse group of professionals from inside and outside the fire service were assembled in Fairfax (VA) to evaluate the usefulness of CRM in the fire service and its potential value. They took time out of their busy schedules to share their knowledge and experience with CRM, determine if CRM would be of value to the fire service, opine on how CRM should be implemented in the fire service, and provide guidance on how to introduce and implement CRM in the fire service. The cohort members are listed with their 1999-2001 affiliations.

The late Chief Alan Brunacini, Phoenix Fire Department (Arizona)

Chief Robert Carter, Hudson Fire Department (Ohio)

Captain Mike Colgan, National Incident Management System Consortium (California)

Jeff Dyar, National Fire Academy (Maryland)

LTJG Michael Guldin, U.S. Coast Guard (District of Columbia)

Christopher Hart, Federal Aviation Administration (District of Columbia)

The late Dr. Robert Helmreich, Ph.D., University of Texas (Texas) (considered the father of CRM)

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The members of IAFC Safety, Health and Survival Section for their editorial work.

Chief Scott Kerwood (Hutto, TX)

Past Chair, IAFC Safety, Health and Survival Section

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# INTRODUCTION

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An engine company with an officer, driver and two firefighters arrive at the scene of an "outside fire" in the early morning hours of a hot, muggy summer night. This is the eighth run for the shift, and the third after midnight. They observe grass burning at the base of a utility pole, threatening a line of overfilled roller trash bins at the curb. The crew sleepily dismounts from the engine. The firefighters go for the rig's "trash line" while the officer provides dispatch with an on-scene report. The engineer charges the line, and the firefighters move up to cut the fire off from the roller bins as the officer dismounts from the engine.

As the handline team moves closer to the utility pole, the engineer turns from the pump panel after switching on the pumper's telescoping flood light. She notices a power line hanging down from the pole and yells a warning to the attack team just before the firefighter on the nozzle sweeps the stream toward the utility pole. The crew shuts the line down and retreats to safety as a bright arc erupts from the point where the power line is touching the ground and the limp power line whips around like an angry snake. A loud report fills the air as the fuse on the pole releases. All four crew members are now wide awake…

No one intentionally sets out to commit an error, but the consequences can have irreversible results. Captain Edward J. Smith, one of the world's most experienced sea captains of the era, was diligently working to validate the White Star Lines' claims that the latest ship under his command was the largest, fastest, safest liner in the world. The ship's vaunted invincibility and power lulled Smith and the ship's crew into a false sense of security as it traversed the North Atlantic on its fateful maiden voyage in April 1912. The story of the Titanic is legend, and a case study for how crew resource management could have changed a tragic outcome.

The same can be said for military leaders, airline pilots, air traffic controllers railroad engineers, physicians, incident commanders and company officers. Commanders and officers at Kansas City's Southwest Boulevard Fire (1959), New York's 23rd Street Fire (1966), Boston's Vendome Fire (1972), the Kingman Explosion (1973), Kansas City Trailer Fire (1988), South Canyon Fire (1994), Pang Warehouse Fire (1995), Worcester Cold Storage Warehouse Fire (1999), Sofa Super Store Fire (2007), West Fertilizer Fire and Explosion (2013), Yarnell Fire (2013), Houston's Southwest Inn Fire (2013), Toledo's Magnolia Street Fire (2014), Wilmington (DE)'s Lakeview Drive Fire (2016), Baltimore's S. Stricker Street Fire (2022), and scores of other line-of-duty death (LODD) incidents did not intentionally or maliciously place personnel in harm's way. However human behavior patterns suggest that even the most well-intentioned, best-trained, consistently high performing individuals and work groups are prone to commit errors. More often than not, these errors are miniscule in scope and, on the surface, seem to have little or no impact on events. Others appear singular and calamitous. After action reports identify "human error" as a significant contributing factor to tragedy. And we now know that error is often more like a wave than a lightning strike in its origin.

Error and oversight compound, if left uninterrupted, and build to a point where there is no more capacity to absorb the consequences leading to tragedy. One thing we have learned through postmortems and post incident analyses is the chain of error that leads to tragedy can be interrupted, if we properly react to the signs and signals placed right in front of our senses.

The purpose of this manual is simple - continue encouraging fire departments to adopt CRM. The "why" is also simple. CRM has:

- sparked top-to-bottom behavioral change in several high-risk industries that have improved leader performance and follower safety. These industries include aviation, military, medicine, and rail,
- revolutionized approaching high risk activities,
- saved worker and patient lives,
- made leaders more effective,
- made teams more efficient, and
- reduced damage to equipment.

We know "accidents" are not random occurrences. An act, or series of acts, committed by a person, or persons, are the overwhelming "cause" of what should more appropriately be called calamities. Unintentional acts of omission, falling into five categories of behavior addressed by CRM tenets can be intercepted to prevent or lessen the impact of calamity.. The concepts introduced in this manual have a proven history (over 40 years) of reducing errors, "accidents," injuries, and deaths in multiple high risk industries with work group structures paralleling the fire service.

This manual is your introduction (or reintroduction if you are already familiar with the concepts) with a validated approach that reduces preventable firefighter injury and death. As you make your way through the manual, be open and receptive to adopt, implement (or reinforce) a proven approach to reducing error, injury, and preventable fatality. Welcome to Crew Resource Management.

# Tragic Watersheds

On July 1, 1988, the Hackensack (NJ) Fire Department responded to a fire in the service bay area of the Hackensack Ford dealership. Arriving units found a well- developed fire in the bowstring truss space above the service bay area. A recall of off-duty personnel was initiated to provide additional resources. Understaffed crews fought the fire for a period of time before being ordered to retreat. A catastrophic collapse occurred before the crews could exit the building. Three firefighters were killed in the initial collapse. Two other firefighters were trapped in a concrete block room used to secure mechanics' tools. Numerous radio transmissions were made by the trapped firefighters, telling command where the men were trapped. Command answered one of the transmissions but called the wrong unit. Repeated calls from the trapped firefighters went unanswered. Video footage of the incident shows a chaotic scene. The incident commander is seen with his portable radio slung over his shoulder participating in the firefighting operations. After 27 calls for help, the radio goes silent. The two entombed firefighters run out of air and suffocate, bringing the death toll to five and completely demoralizing the 100-member department.

On October 27, 1997, the District of Columbia Fire Department responded to a fire in a corner grocery at Fourth and Kennedy Streets, N.W. DCFD crews initiated an aggressive interior attack on the fire. The fire, however, had already gained considerable control of the building. Crews evacuated the building after feeling heat rapidly building up and the floor shift. The crew of Engine 14 exited and realized their officer was not with them. They reported their discovery to another officer who told them he was sure their officer was somewhere—they just became separated by the confusion.

The crew was unable to find their officer, so they again reported their missing officer to yet another officer. Several minutes passed before Engine 14's crew could get anyone to believe them. The fire was extinguished after an extended defensive operation and a search was conducted. The missing officer was found dead in the basement. Post incident analysis of the radio transmissions identified a single call from the officer ("14's in the basement") that was not heard on the fireground. Several other microphone clicks can be heard and were suspected (but not confirmed) as coming from the officer.

The Bryan (TX) Fire Department was alerted to a structure fire in a Knights of Columbus Hall on the evening of February 15, 2013. Three engines, one ladder, one medic unit, one battalion chief, and an EMS supervisor responded. Mutual aid was requested from the College Station Fire Department.

Units arrived to find a working fire in the hall. During firefighting operations, a lieutenant from one of the engines lost contact with his crew and called a Mayday. The rapid intervention team was activated and entered the structure to find the lost officer. A rapid build-up of heat led to a flashover that killed the lost lieutenant and the lieutenant on the rapid intervention team. Two other firefighters were burned in the incident.

The wildland fire service has not been spared tragedy either. On July 6, 1994, wildland firefighters from the Bureau of Land Management, U.S. Forest Service Smoke Jumpers, Prineville Hotshots, and a helitak team were fighting a drought fed fire in rough terrain near Glenwood Springs (CO). A strong weather front came through on the afternoon of July 6, creating a blow up that caught the crews by surprise. In the ensuing scramble for survival, 14 wildland firefighters were killed in what came to be known as the South Canyon or Storm King Mountain Fire. The investigative report identified multiple errors that contributed to the fatalities and injuries.

On June 30, 2013, 20 members of the elite Granite Mountain Interagency Hotshots from Prescott (AZ) were dispatched to a fire in the drought plagued Yarnell Hill area of Arizona. One member who was not feeling well was assigned as a safety lookout. The remaining 19 members were killed when a shift in the weather cut off the members' escape route. Although shelters were deployed, the intense heat and speed of the fire took the 19 lives.

The DCFD officer died nine years after the Hackensack tragedy. The two lieutenants from Bryan, Texas died 16 years after the DCFD officer, and 25 years after the Hackensack firefighters. The Yarnell tragedy occurred nearly 19 years to the day of the South Canyon Fire and 64 years after the tragic Mann Gulch Fire in the Helena (MT) National Forest that claimed the lives of 12 smoke jumpers and one additional wildland firefighter.

Firefighters have died in firefighting operations in places as wide-ranging as Worcester, Massachusetts; Keokuk, Iowa; Louisville, Kentucky; Contra Costa, California; Detroit, Michigan: Colerain Township, Ohio; New York City, New York, Redding, California, San Antonio, Texas, Scipio Township, Indiana, Fort Jackson, South Carolina, West, Texas, Waynoka, Oklahoma, and Wickliffe, Kentucky. Despite the diverse locations and circumstances, several common threads appear in each of these events as well as countless others. Factors contributing to these tragedies, and scores of others, are remarkably like factors identified in aviation disasters, medical mistakes, military catastrophes, and rail calamities. The aviation community was the catalyst entity nearly forty-five years ago that took intentional steps to interrupt the disaster chain.

Aviation accident investigators came to recognize that human error was the prevailing cause in aviation disasters. They embarked on a long, arduous, and sometimes acrimonious trek to change behaviors and traditions to reduce the likelihood of repeat tragedies. The lessons learned by this industry are worth study by the fire service because of commonalities in how:

- both organize people into work groups,
- command is structured, and
- commonalities in LODD contributing factors.

The commercial aviation captain was considered omnipotent when it came to the flight cockpit. Air crew hierarchy explicitly deferred to the captain for all matters before the advent of CRM. This mindset led to a rigid but fragile structure that created iron handed rule, subordinate silence, deference in the face of overwhelming information counter to the captain's orders, and a string of tragedies that were repeated with a soul crushing frequency.

Until the formal 2002 introduction of CRM to the fire service, the same leadership culture could be found in many fire departments. And to many departments not yet aware or practicing CRM, the culture still exists today. In environments that don't cultivate an operational mindset of input and respectful challenge, the probability of calamity and tragedy is heightened. All high-risk industries ultimately rely on people to accomplish tasks and meet objectives involving life-or-death decisions and actions. With a person's very humanity identified as a significant cause of tragedy, efforts to reduce death, injury and calamities need to be steeped in doctrine addressing human performance.

CREDIT: SIMPLEFLYING.COM/SHUTTERSTOCK

## A Tale of Two Flights

United Airlines Flight 173 was on final approach to Portland International Airport after an uneventful flight on December 28, 1978. The cockpit crew of three consisted of an experienced DC-8 pilot, first officer and flight engineer. Eight flight attendants and 181 passengers occupied the cabin. The pilot noticed that he had not received the usual "three down and green" indicator lights telling him that

all landing gear was properly deployed. The nose gear light failed to illuminate green. The pilot notified the air traffic control center and requested additional flight time to resolve the situation. He went through his checklists while circling. Despite the crew's efforts, the nose gear landing light continued to glow "red" indicating the gear was not locked into position.

Throughout the troubleshooting the first officer and flight engineer had attempted to inform the pilot the plane was running low on fuel. The pilot either ignored the warnings or did not comprehend the messages. Approximately six miles southeast of the airport runway, the perfectly capable, but fuel starved plane crashed into a wooded residential area. Eight passengers and two crew members were killed, and 23 people were seriously injured. The lack of a post-crash fire kept the death toll mercifully low. The lack of communication skills under stress, situational awareness, team building, decision making, and task allocation sent the plane into the ground well short of the airfield. The post-crash analysis determined that the green light indicator for the nose landing gear had a burned-out bulb. The nose gear had been down and locked the entire time.

Flight 173's disaster was one of the catalysts for the aviation industry's recognition that technology alone was not the cause of air mishaps. A bold, new thinking evolved thanks to Dr. Robert Helmreich and his hypothesis on why the plane had been allowed to run out of fuel. The DC-8 used by Flight 173 was a fully functional, mechanically sound air- frame that crashed because the senior machine became hyper-engrossed in a problem that turned out to be a $.69 burned-out light bulb. When the crew attempted to point out the plane had been in the air for a long time, the pilot shut down their concerns by exerting seniority and authority. By focusing on the burned out light, they "forgot" to keep flying the plane. As a result of this disaster, a new training program was implemented. The program sought to capture and minimize the impact of human frailty. "Cockpit" Resource Management had arrived.

The airline industry's senior pilots initially rejected the program. They considered the concept "charm school" and not focused on mission completion. In addition, the industry's "chain of command" had a traditionally rigid hierarchy with an autocratic captain and subservient flight crew. The cabin crew was not even considered part of the flying team. This tradition closely mirrored the maritime industry's concept of the captain being "master of the ship." Airline owners, safety professionals, and other captains, however, held fast. Cockpit Resource Management evolved into Crew Resource Management, and the training became mandatory for all pilots and flight crews.

Flash forward to July 1989. United Airlines Flight 232 is on its way to Los Angeles from Chicago. The plane experiences an in-flight catastrophic failure of one of its engines. Parts are hurled in all directions. Shrapnel penetrates the plane's body severing all three hydraulic lines necessary for controlling flaps, rudders, and other flight controls. The damage robs the crew of primary and redundant safety features built into every airframe. The flight crew, aided by a check ride pilot who came forward from the passenger cabin to offer assistance, and using engine controls alone, manage to bring the crippled plane into the Sioux City, Iowa airport. The plane made a spectacular crash landing captured on film by media news crews. Tragically, 111 people were killed in the crash. However, 184 survived. What actions did the crew of Flight 232 take to save the 184 passengers? The crew, led by the captain, initiated behaviors learned in a training program. The program taught strategies in five domains to reduce susceptibility to human error. The captain, crew and additional pilot attributed their success to Cockpit Resource Management. CRM finally had the landmark event necessary to validate its worth.

CREDIT: CHERI COMPTON

# CRM in the Fire Service: Breaking the Chain of Complacency

Additional industries looked into and adopted CRM throughout the 1980s and 1990s. The medical field, military and maritime trades introduced CRM into their fields with dramatic results. The United States Coast Guard reported a 74% reduction in its injury rate since adopting CRM (Welicka, 2001). U.S. air disasters (not related to terrorism) had fallen from approximately 20 per year to one to two per year (Hart, 2000). Between 2001 and 2023, U. S. commercial air carriers recorded fourteen air disasters in the U.S. (excluding the terror attack of 9/11) in approximately 20,580,000 flights (transtats.bts.gov), demonstrating how much the industry's safety record has improved.

The fire service in the United States has made inroads into its LODD rate over the last three decades (Fahy, et. al,. 2017), but the numbers can be misleading. Changes in the structural firefighting environment (i.e., fuel package heat release rates, open floor plans, engineered structural members, poor construction, flow paths, ventilation, heat transfer, etc.) without corresponding changes in tactics are still trapping firefighters in untenable conditions, resulting in death and injury annually. The increase in the number and intensity of wildland fires and fires in the wildland urban interface are creating scenarios where the probability of killing and injuring firefighters remains high.

None of the deaths or injuries is considered an intentional act. Firefighters do not report for duty and state, "Today I will take actions that will intentionally kill and/or injure my colleagues and/or me." There are voices insisting all has been done for firefighter safety, and we are living with the best possible circumstances. Spirited debates state firefighting is by its very nature a dangerous proposition and any further change in firefighting tactics will put firefighters outside the building on all fires and essentially out of business. Others argue that if the fire service does not embrace a better way to do business, they will be kept out of buildings by forces beyond their control (e.g., local government legislation, insurance carriers, etc.).

While the causes of many firefighter LODDs are classified as "thermal insult," "blunt force trauma" and "acute stress," reading between the lines of LODD reports reveals causations steeped more in the realm of human behaviors, not the environmental factors.

The fireground is a high intensity, dynamic experience for humans. Significant releases of adrenaline are involved, combined with intensely ingrained cultural beliefs and the influence of time. These three factors confluence as firefighters enter combat with an unruly force of nature. Combining these elements creates repeated situations ripe for communication failures, poor decision making, a lack of situational awareness, poor task allocation and general leadership failures. Even the most cursory review of NIOSH Firefighter Line-of-Duty Death Reports confirms these five factors to be frequent and recurring. Since the factors are the same as those cited in aviation disasters, medical errors, rail disasters, and military calamities, and each of these industries has seen a marked decline in tragedies as well as a marked improvement in overall human performance since adopting CRM, it logically follows that training and using CRM would have the same impact on fire service operations. Since CRM's introduction to the fire service in 2002, thousands of fire departments across the country have trained in the concept and are applying the principles. It stands to reason that full adoption of CRM in the fire service would likely result in calamity rate reductions comparable to the other high risk industries that employ the concepts daily (i.e., fatal event frequency rates shifting from multiple annual to infrequent).

Further validating CRM's relevance to the fire service is realized through a comparison of the behaviors, cultures, interactions, and composition of emergency service crews with flight crews, surgical teams, rail workers, and military units. Work groups in each industry are structured with a leader and one or more subordinate members. The work group functions best when it operates as a cohesive team. The team can spend hours of time preparing and performing mundane activities. In an instant, each can be mobilized to act swiftly under highly stressful, time-compressed conditions with limited information. Some of the teams work together frequently while others are assembled on short notice to face the challenge.

Crew Resource Management can be taught using a variety of methods. The airline industry uses a three-step process to teach the five factors (communication, situational awareness, decision making, teamwork, barriers) that comprise CRM. The first step, awareness (which is the function of this text), introduces the concept. The second step, reinforcement, underpins the awareness level by having attendees participate in simulated activities requiring action to overcome problems in the five factors that lead to disaster. The third step, refresh, is a session that reminds participants of the basic concepts and reinforces the five factors through lecture and role play. The second and third steps provide for repetitive (or in-service) training to reinforce the five factors. Colloquially, this methodology is known as the "sets and reps" approach used in team sports, weightlifting, acquiring a new language, or learning a new skill. One of the roots of the model is also based on Klein's concept of Recognition Primed Decision Making. (Recognition Primed Decision Making is explained in greater detail in the Decision-Making section of this text.)

The current airline and military training programs have evolved over a 40-year period. They are still routinely credited with making the skies and military operations safer (APA, 2014). Fire service training programs have emerged at several levels, benefiting primarily from knowledge sharing with the aviation industry and United States Coast Guard. Continuing to get the word out is the primary step in institutionalizing CRM's value in the entire fire service. The first step in becoming CRM savvy is to learn and memorize the five components.

## Communication

Communication is the key to success in any endeavor. We all have experienced misunderstandings that led to errors and mistakes. CRM emphasizes focus on three keys:

- using the communication model (sender-message-medium-receiver-feedback),
- speaking directly as well as respectfully and
- communication responsibility.


CREDIT: WICHITA (KS) FIRE DEPARTMENT

## Situational Awareness (SA)

Situational awareness is a state of mind where one comprehends what is going on in the environment around them. This includes the effect of time and space, as well as a correct projection of future developments. SA recognizes the effects of perception, observation, and stress on the human experience when exposed to high risk, dynamic, time compressed situations. Since firefighters and other emergency responders face these situations with varying frequency, maintaining SA is a key component of CRM.

CREDIT: SOUTHBRIDGE (MA) FIRE DEPARTMENT

## Decision Making

Decision making is based on information. Emergency service decision making relies heavily on risk/benefit analysis and processing factors (SA). Too little information results in poor risk assessment by the decision maker, resulting in errors, injury, and death. Too much information overloads the decision maker and makes it
difficult to sort through the noise to make an effective decision. CRM training concentrates on strategies surrounding the giving and receiving information, as well as the processing of information so appropriate decisions can be made.


CREDIT: WICHITA (KS) FIRE DEPARTMENT

## Teamwork

Any group that fails to perform as a team is doomed to fail. Failure in the emergency service field results in excessive damage, poor crew performance, injury and death. CRM training emphasizes team performance through exercises in the awareness tier and crew performance during the reinforcement tier. The training also focuses on "leadership-followership" so all members understand their place on the team and the need for mutual respect.

CREDIT: JEFFERSON TOWNSHIP (IN) FIRE DEPARTMENT

## Task Allocation

Paraphrasing Edwin Booz (1887-1951), founder of the consulting firm Booz, Allen & Hamilton, "Often the best solution to a problem is the right person." Task allocation is a core tenet that focuses on seeking the person (or people) best qualified to complete a task and letting that person (or people) get the job done.

CREDIT: RURAL METRO (AZ) FIRE DEPARTMENT

## Barriers

A final component addressed in CRM training is recognizing the effect of barriers on the other five factors. Barriers are any influences that inhibit communication, situational awareness, decision making, task allocation, and teamwork. Barriers can be external (physical) or internal (prejudice, opinions, attitudes, stress). The CRM segment on barriers focuses on recognizing that barriers exist and taking steps to neutralize their negative effect.

CREDIT: ALIEXPRESS.COM

Crew Resource Management (CRM) requires commitment. Experience shows the concept is not universally embraced when first introduced. The tenets challenge long held constructs of some organizations leadership and operating cultures. The similarities between the crew of a flight deck and the cab of an emergency vehicle suggest that CRM has a natural application to the emergency services. CRM's goals of minimizing the effect human error has on operations and maximizing human performance are a natural fit for managing emergencies. Crews trained in CRM learn skills that enhance communication, maintain situational awareness, strengthen decision making, assign tasks to the most qualified person, and improve teamwork. The U.S. military, commercial aviation, medical, rail, and shipping industries are actively using the concept, as well as an increasing number of fire departments. Memorializing CRM in all fire departments is the next logical step toward a more effective, safer service.

Approximately 500 firefighters will die and 500,000 will be injured on the emergency scene over the next decade if the fire service doesn't seek other strategies to reduce risk. Advances in technology keep us well protected from thermal insult and smoke. Improved accountability monitoring is improving tracking of firefighters in buildings. All of these technologies act as defense layers against the effects of human error. However, technology still has shortfalls since it is built and operated by humans. The aviation community identified this pattern in its paradigm shift to arrest the chain of events that leads to disaster. They realized all of the technology possible couldn't overcome the influence of human error. The fire service recognizes at various levels that human error is a contributing factor to LODDs and injuries, but has yet to fully comprehend and embrace the full effect of human frailty. If we do not take action to more fully arrest the effects of adrenaline, machismo (cholesterol requires another approach) and antiquated practices, we are doomed to continue a history of grand funerals, losses, broken families, and mentally injured co-workers. Universally embracing CRM is critical to reducing preventable firefighter death and injury. The fire service will realize the same benefits other industries have achieved by adopting CRMs half-century of proven success.

## What is Crew Resource Management (CRM)?

Simply put, Crew Resource Management is the effective use of all resources. The Federal Aviation Administration's Advisory Rule expands the definition to include software, hardware and humanware in its definition. The ultimate goal for the FAA is achieving safe and efficient flight operations, a goal equally held by the fire service. Their specific listing of software, hardware and humanware is meant to emphasize the point that problem solving involves using all available tools and not just relying on technology alone.

## What CRM isn't?

CRM is not an attempt to undermine the legal ranking fire officer's authority. Nor is CRM management by committee. Tom Lubnau and Randy Okray observed that CRM is a "force multiplier" (Lubnau, et. al., 2001). In fact, authority and leadership is actually enhanced through the use of CRM. All team members direct information flow to the leader. This input augments the leader's situational awareness, resulting in a more informed decision.

While opinions are valid, the final decision on a course of action still rests with the team leader. Using CRM provides for:

- better teamwork
- improved communication and problem-solving skills
- better decision making
- an operating philosophy that promotes team member input while preserving legal authority
- proactive accident prevention

# COMMUNICATION

## Overview

There is universal agreement that communication is the key to success in any endeavor, and a frequent contributor to tragedy. Firefighters are acutely aware of this fact. A preponderance of firefighter fatality incidents list communication breakdowns as contributing factors. Some particularly poignant examples of how communication breakdowns impacted firefighter safety include: Hackensack Ford (Hackensack, NJ, July 1988), 1 Meridian Plaza (Philadelphia, PA, February 1991), Storm King Mountain (Colorado, July 1994), Louisville House Fire (Louisville, KY, February 1997), Kennedy Street (Washington, DC, October 1997), World Trade Center Attack (New York City, September 2001), Tai Ho Restaurant (Boston, MA, August 2007), Southwest Inn (Houston, TX, May 2013), King Towers Apartments (Cincinnati, OH, March 2015), Cote Brilliante (St. Louis, MO, January 2022).. These are but a few of the scores of LODD events where communication played a prominent or significant contributing role in the tragedy. Interruptions in the communication flow process resulted in messages being misinterpreted, not properly conveyed, completely missed, or improperly carried out. Each incident left a fire department in mourning, families without loved ones and careers shortened.

CREDIT: SAN BERNARDINO COUNTY (CA) FIRE DEPARTMENT

Communication takes place between at least two people (a sender and a receiver) and generally involves six steps.

- The sender formulates an idea in Step 1
- That idea is encoded as a message in Step 2
- The message is projected through a medium in Step 3
- The receiver receives the message in Step 4
- The receiver decodes the message in Step 5
- The receiver confirms understanding by providing feedback to the sender in Step 6

Errors occur throughout the communication process, contributing to miscommunication. At its worst, miscommunication results in injury and death. These errors can be divided into three categories: sender errors, receiver errors and filters or roadblocks.

## Sender Errors

A response of, "What do you mean?" is a good indicator the receiver has missed the sender's message. There are a variety of reasons why this occurs. The most frequently encountered problems are:

- **Not establishing a frame of reference.** If the receiver is not on the same page as the sender, miscommunication occurs.
- **Omission of information.** The sender leaves out pertinent details that affect a receiver's ability to comprehend what is being said. "Pull that line" leaves quite a few unanswered questions. "Pull the front crosslay to the front door and standby until I finish my 360" gives the receiver more direction and mission definition.
- **Providing biased or weighted information.** Inserting the sender's opinion when providing information.
- **Assuming messages only depend on words.** The sender underestimates the power and importance of tone and body language.
- **Not willing to repeat information.** We normally talk at about 125 words/minute and think at 500-1,000 words/minute. Senders who only say something once run a very high risk of failure if they think their message penetrates all of the thinking, talking and other external stimuli.
- **Disrespectful communication.** Want to ensure your message is blocked? Open your communication with an insult, demeaning or degrading remark.

## Receiver Errors

- A receiver also can make mistakes, disrupting the communication chain (remember, to err is human). Receiver errors generally fall into six categories.
- **Listening with a preconceived notion.** The receiver already has their mind made up about what the message will be before the sender can formulate a thought.
- **Poor preparation.** Receiving messages is more than just allowing the words to pass through your ears. Receiving a message is a conscious process.
- **Thinking ahead of the sender.** Extrapolating the sender's thoughts, putting words into someone's mouth, finishing sentences for a sender, formulating a response before the sender finishes (the trigger phrase here is "Hear me out," from the sender) are all examples of thinking ahead of the sender.
- **Missing the non-verbal signals.** Overlooking body language and facial expressions can be crippling when it comes to interpreting communications.
- **Not asking for clarification.** Failing to employ the old standby, "So what you are saying is . . ." can be the death of good communication.
- **Disrespectful communication.** Want to slam the door shut on a message? Respond with an insult, demeaning or degrading remark.

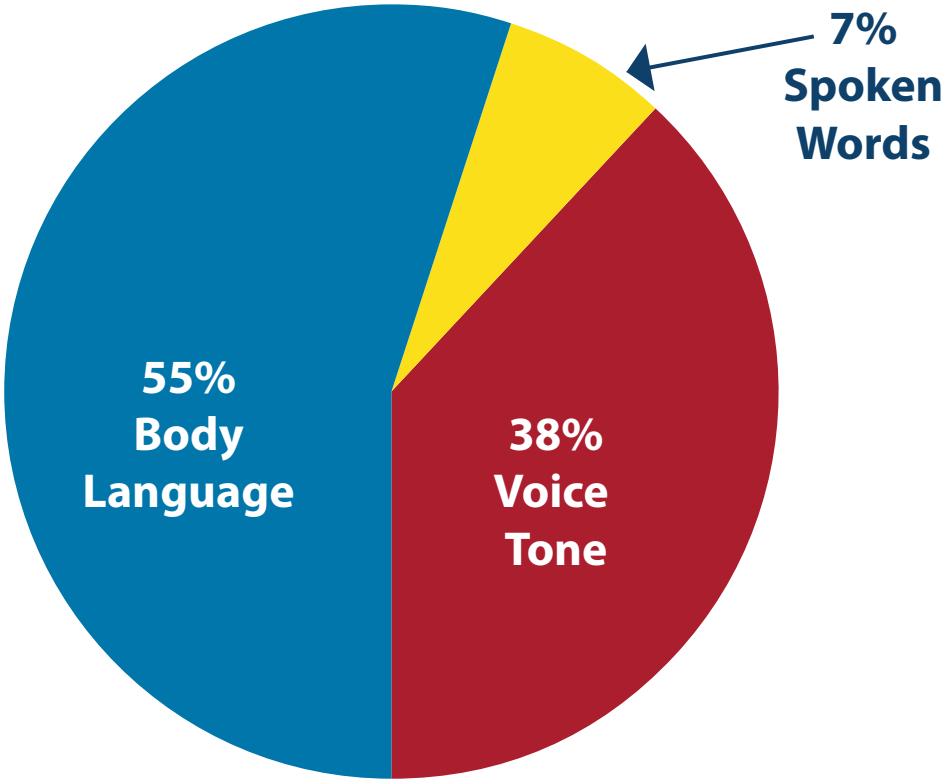
# Filters and Roadblocks

We bring certain impressions to the table as we communicate. These impressions are based on how we were raised by our parental influences, life experiences and the influence of others. When we communicate with others, these impressions can serve to interrupt communication. Being aware of these "filters" prior to communicating can prevent the communication from becoming a conflict. Some of these filters, sometimes called "roadblocks," (National Wildfire Coordinating Group, 2000) include:

- A natural resistance to change initial impression
- Defending ourselves from looking foolish or stupid
- Supporting our opinion even when it is not truly correct
- Blaming others when our message is misunderstood
- Intentionally withholding information that could benefit the group
- The Halo Effect (usually bestowed on a group member thought to be infallible)


CREDIT: JOCELYN AUGUSTINO, FEMA

# Conveying Thoughts




- "Odd Man Out" (a crew member who does not have the ear of the group because of tenure, race, creed or gender)
- Complacency
- Fatigue
- Reckless attitude (risk taker who does not use a risk/benefit analysis).

The cornerstone principle of CRM is effective communication. All of the remaining components are built on or influenced by communication. Speaking comes to mind as the principal method of communication, but we actually convey messages three ways: verbally (words), tone (inflection) and body language. Of the three ways, body language ranks highest in the ways we convey messages, followed by tone. Words, while important, are the trailing method of conveying thought.

Every time air passes our vocal cords, we are communicating verbally (words/tone). Body language (non-verbal communication) takes place over a wider range of media as it involves incorporating sight for interpretation and, as the chart indicates, has a greater impact on conveying messages. Facial expressions, body posture, gestures and dress are the components of body language.

Communicating in CRM boils down to this: senders respectfully communicating what is meant in clear text, including confirmation of understanding; and receivers being alert for messages and providing feedback to confirm understanding. Errors are reduced through clear, concise, complete communication, injuries are avoided and performance is enhanced. CRM accomplishes the clear communication process by concentrating on developing five skills: inquiry, advocacy, listening, conflict resolution and critique (or feedback). Learning and employing these skills places firefighters in a position to proactively stay ahead of the injury and death curve.

# Inquiry

Curiosity is a natural human trait. Wondering how things work, challenging the status quo, raging against the machine, or the simple "Why?" all contribute to how we learn and how we apply what we learn. Inquiry in the CRM world maximizes the positive aspects of this human trait. Firefighters are provided with a tool to "raise their hand" in the name of self-preservation and protection. Inquiry is not a revolutionary concept in the fire service. It is already an ingrained process in a firefighter's decision making. The first question of size up (a firefighter's fundamental obligation at any emergency) is, "What do we have?"

CRM inquiry is revolutionary in its empowerment to everyone on the emergency scene. Inquiry encourages firefighters to speak up (respectfully) for maximum effect. When they recognize that a discrepancy exists between what is happening and what should be happening. A three-person engine company is stretching a handline to begin an attack at a single-family dwelling. The officer, preoccupied with assisting with the hoseline stretch, misses the fact that the smoke coming from the eaves has darkened, thickened and gained speed. The pump operator notices, calls to the officer and asks the officer if he sees the change. The officer looks up, recognizes the hazard and directs the line to be directed at the now flaming soffit. The pump operator's initial action (calling to the officer) is inquiry. Calling the officer's attention to the developing hazard leads to mitigation. In inquiry the subordinate needs to be proactive, use clear concise questions and express concerns accurately.

# Advocacy

What next? Questioning the wisdom of a superior's decision can be gut wrenching. As a subordinate, how do you approach a superior and tell him that a foul up is brewing? The answer lies in being an advocate of your position. The most effective method for advocating is through the use of Todd Bishop's assertive statement outlined in Section I, Leadership/Followership. The five parts of the assertive statement are:

- An opening statement using the addressed person's name ("Dave," "Captain," "Chief")
- Stating your concern as an owned emotion ("I think we are heading for a problem…")
- Stating the problem as you see it ("It looks like that building is getting ready to flash")
- Offering a solution ("I think we should evacuate the interior crews right now")
- Obtaining agreement ("Do you agree?")

Using advocacy helps promote situational awareness, improve understanding and avoid catastrophe. When firefighters use advocacy, they rightfully believe they are in charge of their destiny and become more willing to meet goals and objectives.

CREDIT: JOHN TIPPETT

# Listening

"Did you understand what I said?" and "What did he say?" are two of the most frequently uttered statements in affirming active listening is taking place. Unfortunately, not asking these questions is a significant contributing factor to errors.

Listening is a fluid, dynamic process that involves more than just hearing. The full act of listening includes watching and processing verbal and non-verbal forms of communication to gain total understanding. Becoming an effective listener is a learned trait that requires practice and active attention. Part of that learning process is being aware of obstacles that affect active listening. An active listener learns to avoid the traps that prevent listening and comprehension. Consider the following to become a better listener:

- Use all senses to stay focused on the sender
- Make eye contact with the sender
- Suppress filters that affect listening (personal prejudices, preconceived opinions, gossip)
- Repeat the sender's message to confirm understanding
- Create an environment conducive to communication (move away from the command net radios, running equipment, etcetera, so you can hear a face-to-face conversation).

The active listener overcomes the majority of problems encountered in our environment through mastery of the art of listening. The learned skill of listening also is dependent upon several other factors such as maintaining situational awareness and being in good overall health. When filters, cultural roadblocks or other problems impede listening, errors emerge in a way that is truly reflected in the line from the movie Cool Hand Luke: "What we have here is a failure to communicate."

# Conflict Resolution

Conflict is a normal occurrence in group dynamics. Conflict is the natural result of people thinking. Everyone should expect that at some point in time there will be conflict in groups. Once group members are prepared for the inevitable, resolving conflict becomes an easier experience. Conflict resolution techniques are an integral part of CRM. The principal key to conflict resolution revolves around "what is right", not "who is right" (Lubnau).

Staying focused on the issue at hand is a cardinal rule in conflict resolution. It is also one of the most difficult to employ. Therefore, all participants must continually remind themselves to devote all attention to the current source of conflict. Conflict resolution is not the place to open old wounds. Biases need to be put aside. Concentrating all efforts on resolution is the primary goal of everyone involved.

# Feedback

The final step in the communication process is to provide feedback. Feedback confirms comprehension. Providing feedback is also known as "critiquing." Conscious feedback must be provided during every communication interaction. After-action reports, critiques and post-incident analyses are already well-known terms in the fire service. These are all forms of feedback.

The fundamental objective of feedback is to confirm understanding. Once feedback has been provided to the sender in the communication process, communication is considered complete. Feedback in the form of a critique also serves to reinforce communication.

The goal of any communication is to send information. For the communication to be complete, feedback must be supplied to ensure understanding. Complete and successful communication involves using verbal and non-verbal messaging understood by the sender and receiver. Communication is not complete until the loop is complete.

The crux of CRM is effective communication. Time and again disaster analysis and tragedy reconstructions point to breaks in the communication loop as contributory and often the principal cause. Our history is overflowing with examples of communication breakdowns that resulted in death, injury, damaged equipment, broken relationships, and dysfunctional teams. Improving communication skills has far reaching effects on reducing LODD, injury and property damage rates, as well as improving safety and overall performance. Improvement is achieved in the same manner firefighters become proficient at donning their PPE, reading smoke, advancing hoselines, cutting a handline, setting up a rural water operation, or throwing ladders. Practice makes perfect.


CREDIT: BATH TOWNSHIP (OH) FIRE DEPARTMENT

# LEADERSHIP/FOLLOWERSHIP - TEAMWORK AS A GROUP EFFORT

Teamwork requires group members to cooperate in order to accomplish common goals. Goal accomplishment requires someone (a leader) to identify what the goals are and at least one other person, or group of people (followers), to perform tasks that will achieve the established goals. The very nature of fire service work requires that people work in groups to accomplish tasks. Breakdowns in teamwork result in one of two outcomes: inefficient goal attainment and injuries.

## Leadership

Fire service leadership is established by both formal and informal mechanisms. Laws enacted by local governments define the mission and structure of a fire department. The internal structure of the fire service has traditionally followed a quasi-military structure that defines lines of authority. Department members in leadership positions from chief to company officer are obligated to acquire and develop leadership skills that best serve the community and the department. Human behavior specialists have identified four leadership skills that are critical to the leadership function. These skills are authority, mentoring, conflict resolution and mission analysis.

## Authority

CRM recognizes and reinforces the legitimate authority of the fire department structure through four points. Point one is ensuring mission safety, the first requirement of every assignment. Every fire service leader and the people led know various levels of risk exist in the fire service. They expect to be able to carry out their assigned tasks and return home safely to their loved ones. Mission safety requires the commitment of all members. However, the ultimate responsibility for member safety lies with the leader.

The second point legitimizing authority involves fostering an environment of respectful communication among the crew. Respectful communication is a core element of CRM. This conclusion was derived from research of aircraft disasters conducted by the aviation industry. The research and report results strongly suggest that failures to communicate or misunderstood communication (verbal and non-verbal) are significant contributing factors in airline disasters. The same conclusions have been reached in several high-profile fire service disasters (e.g., Storm King Mountain; Hackensack; Washington, D.C.'s Cherry Road). Leaders who are open and promote respectful communication with their personnel are more effective.

Establishing tasks with clearly defined goals is the third point in reinforcing legitimate authority. Personnel clearly thrive and excel when they are given work assignments that have attainable, defined goals. By nature, people want to do a good job. The sense of accomplishment and boost in morale that are derived from accomplishment fuel a member's sense of self-worth, improve performance and heighten the individual's awareness. Highly motivated members satisfied with their performance and entrusted to complete tasks are less likely to sustain injuries, make mistakes or fail.

The fourth point involves including crew input (when appropriate) when activities are altered or situations change. The critical phrase here is "crew input." Leaders do not wake up in the morning and set goals to make decisions that will have the department membership hate them. They often are left to make decisions in a vacuum because of a lack of input from subordinates. Soliciting input is not intended to relieve a leader of the duty to make decisions. Nor is crew input an abdication of authority on the part of the group leader. Actually, the intent of soliciting crew input is to guarantee all factors possible are weighed so the leader's decision making is enhanced. Two sets of eyes see more than one set, four sets see more than two and so on. Force multiplication is an essential component of high functioning teams.

# Mentoring

The second leadership skill necessary to develop is mentoring.Mentoring is a fundamental function of any leadership position. Developing and supporting prospective leaders ensures a department's future. A sense of commitment from department leadership to its members is fostered. Leaders must possess a high degree of self-confidence and commitment in order to mentor others. Self-confidence permits leaders to impart knowledge and allow for a member's personal growth without feeling threatened.

Technical competence is an essential component of mentoring. Technical competence allows a leader to:

- Demonstrate skills and techniques
- Demonstrate professional standards and best practices
- Verbalize errors and limitations promptly
- Recommend solutions to enhance effectiveness
- Monitor and assess crew performance
- Motivate members.

This give-and-take process allows members to develop confidence in their leader, trust the leader's judgment, accept decisions, perform better as a team and grow personally.

CREDIT: GULFPORT (MS) FIRE DEPARTMENT

# Conflict Resolution

Conflict inevitably arises in groups. Conflict can be healthy and unhealthy. Resolving unhealthy conflict quickly and positively promotes harmony and goal accomplishment. One of the double-edged swords of CRM is that it can give rise to conflict if members let their egos get in the way of their reasoning. Recognizing and accepting this point suggests that leaders develop effective conflict resolution skills and followers respectfully address rank with their concerns.

A frequently heard opening complaint in conflict resolution is, "The other side is not listening to me." Arresting this complaint can be rather simple. The first step is to provide a legitimate avenue for dissent. Leaders who are accessible and acknowledge differences of opinion are halfway toward positive conflict resolution.

The second step can be more complicated. Emotions can run high during periods of conflict, clouding the root cause (or causes) of conflict. However, adhering to communication best practices, using active listening techniques, avoiding emotional involvement and staying focused on cause identification can help a leader weed through the rhetoric and identify core conflict issues.

Crew members should be encouraged to diplomatically question the actions/decisions of others. Fostering this aspect of conflict resolution is not without some heartburn. Zealots empowered to "question authority" believe they have the right to challenge all decisions made by leadership under the guise of CRM. Nothing could be further from the truth. Questioning authority in the CRM world should more appropriately be termed

"confirming situational awareness." (Note: Situational awareness will be discussed in depth in a later section.) Expressing a difference of opinion diplomatically and in a non-threatening way can be accomplished using Todd Bishop's five-step Assertive Statement method.

1. Opening/attention – Say the person's name.
2. State concern/owned emotion – "I'm very uncomfortable with. . ."
3. State the problem as you see it – real or perceived.
4. Offer a solution – "I think we should . . ." (Major success key)
5. Obtain agreement – "What do you think?"

Bishop's Assertive Statement method should be used where risks are low, time is not a factor and lives are not in danger. While offering a solution is considered a major success key in the assertive statement, the lack of a solution should not prevent a crew member from pointing out a potential problem.

A second, more forceful method is available but should be reserved for those situations where members are engaged in high-risk activities and the potential for tragedy is real and imminent. This method is known as the "This is Stupid!" (TIS) technique. Asserting opinion in this environment is reserved for life threatening situations. It is the "red flag" of respectful communicating in the leadership/followership arena. The statement focuses on actions, not individuals. Therein lies its successful key. If the statement were turned to say, "You are stupid!" the leader becomes defensive. This defensive posture leads to an inability to see the potentially tragic error because of the distracting nature of a personal attack. "TIS" is the last tool in the toolbox; prudently and judiciously used to get the leader's attention to review actions or activities that are perceived to be exceeding the risk/reward assessment. A department may wish to create or develop its own "call sign" to indicate a "TIS" event is occurring. This call sign should be simple and recognizable by every crew member. Call signs offer the benefit of being less inflammatory than "This is stupid," but carry the same "let's review what's going on here, now!" weight. Some examples of TIS call signs include: "red flag," "TIS" and "red light."

Successful leaders accept conflict as a normal component of leading people. A CRM trained leader will acknowledge the difference of opinion, accept constructive criticism and recognize that differences of opinion will crop up within any work group. The leader's response to criticism will drive successful goal attainment and prevent injuries to the group. Effective leaders recognize differences of opinion exist, accept constructive criticism, actively listen to what subordinates are saying, employ subordinate counsel and reinforce the final decision rests with the leader.

## Mission Analysis

The final leadership skill to develop is mission analysis. Mission analysis can be likened to the size-up process. Its components include: evaluating risk versus gain, identifying objectives, developing strategies and tactics to meet the identified objectives, implementing an action plan, expecting the unexpected, evaluating the effectiveness of the action plan (critiquing) and devising alternative strategies. Most fire officers are well versed in the size-up process. Mission analysis, therefore, should be the easiest skill in the CRM Leadership/Followership component to develop.

**Editor's Note:** The five-step "Assertive Statement" was developed and trademarked by Todd Bishop, Vice President, Error Prevention Institute Incorporated. Used with permission. EPI specializes in Error Prevention Training. See bibliography for contact information.

# Followership

Goal attainment and teamwork require people who can think and follow direction. CRM empowers followers to respectfully challenge a leader's decisions to ensure the best decision is being made with the most available and current facts. This empowerment is not doled out indiscriminately or without thought. Followers have a significant obligation to meet in order to maintain their right to challenge a leader. One of the core tenets of CRM is that the authority of the leader is preserved and protected unless the leader is incapacitated. In order for followers to be at their peak, they have to be at the top of their game and develop skills to be more effective. Ensuring maximum efficiency requires self-assessment.

# Self-Assessment

The physical and mental condition of any team member is critical to mission success. Being at the top of one's game is also a crucial factor in error recognition and mitigation. Alert, oriented people do not make mistakes. Since CRM recognizes that to err is human, being alert and oriented (i.e., maintaining situational awareness) is an incumbent requirement of every team member.

Being physically fit is becoming a fire service standard. The physical and mental demands of the job require participants to be in the best health possible. This health requirement carries through to CRM as well. There is a wealth of information and programs available to assist firefighters in staying healthy.

**In a nutshell, followers need to be: Physically fit ★ Hydrated ★ Nourished ★ Rested**

PHOTO CREDITS: TOP LEFT: MIAMI-DADE (FL) FIRE RESCUE; TOP RIGHT: BATH (OH) FIRE DEPARTMENT; BOTTOM LEFT: ADAMS COUNTY (CO) FIRE RESCUE; BOTTOM RIGHT: WILDFIRE TODAY

Mental condition is also a critical followership self-assessment category. People, regardless of their task assignment or organizational position, make fewer mistakes when they are focused on their assigned tasks. Good followers understand that stress is an operational distractor. Stress is a function of any number of outside influences. Some stresses are interpersonal, others environmental. Identifying sources of stress, recognizing stress affects performance and taking steps to minimize stress are all necessary in the effective use of CRM.

## Sources of Stress

- Anxity
- Frustration
- Noise
- Temperature Extremes
- Hydration
- Drugs
- Fear
- Anger
- Vibration
- Hunger
- Time Pressure
- Incentives
- Time of Day
- Training
- Alertness
- Lack of Rest
- Punishments/Reprisals

CREDIT: SAN BERNARDINO COUNTY (CA) FIRE DEPARTMENT

Understanding the human animal is not a requirement reserved for leaders. Attitude, memory limits and behavioral tendencies play a significant role in followership as well. The term attitude is often overused. However, the components of attitude, frame of mind, prejudices and interests all play a role in the actions and interactions of people. The leader's role is to create an environment where crew members can feel comfortable coming forward with a stress event that may impair their performance.

Recognizing memory limits is a trait that reminds followers that leaders can be extremely capable, but nonetheless human. Typically, people can remember up to ten items (recall the cadence of the ABCs?). Armed with this fact, followers can assist leaders by making up the difference and referring to checklists.

Knowledge of behavioral tendencies also can provide followers with tools to be effective team members.

## Follwership Skills

- Respect authority.
- Be safe.
- Keep your fellow followers and leaders safe.
- Accept that authority goes with responsibility.
- Know the limits of your own authority.
- Desire to make the leader succeed.
- Possess good communication skills.
- Develop and maintain a positive learning attitude.
- Keep ego in check.
- Demand clear assignments.
- Establish an assertiveness/authority balance.
- Accept direction and information as needed.
- Publicly acknowledge mistakes.
- Report status of work.
- Be flexible.

Acquiring a knowledge base of how a particular leader reacts in various situations can be extremely beneficial to a follower. This knowledge base provides the follower with the information necessary to develop strategies for approaching and communicating with a leader.

Followers are the power that permits work groups and organizations to achieve goals. We all have to answer to someone, so in essence we are all followers. Even leaders need to be good followers. Consider the list of skills in the call out box as necessary to develop for good followership.

Another mental component to assess is your mental attitude. The FAA has identified five hazardous attitudes pilots exhibit. A noted fire service leader versed in the human factors field, Tony Kern, has identified two others. These attitudes are uncannily applicable to the fire service. We do not have to look around very far to see examples of these attitudes. We may have even exhibited some of these attitudes ourselves. The interesting point to evaluate in the self- assessment arena is how these attitudes affected team performance and what steps do we take to prevent them from wreaking havoc with team operations. The attitudes are: anti-authority, impulsivity, invulnerability, machismo, resignation, pressing and "air show syndrome."

Anti-authority is the "Don't tell me what to do!" attitude. This mindset is a team killer from the start. Think of any situation where this attitude has been displayed. The very root of the independent stance taken by the anti-authority person destroys a team before it can gel. At the very least it forces the team to roll with a bent axle, stressing a team and depriving it of the synergy necessary to accomplish goals.

The second hazardous attitude identified is impulsivity: the "we gotta do something NOW!" view—no forethought, just react. Another term used is "compulsion to act." Failure to assess the scene properly, failure to formulate an action plan (and communicate the plan) and failure to perform any logical thought process before taking action are the hallmarks of impulsivity. In some circles impulsivity is known as "white-eye rollback." We have all seen examples of this behavior. It is the wide- eyed firefighter who leaps from the rig grabbing a hoseline, completely disregarding their safety to do battle with the dreaded demon fire. The firefighter races right up to the very precipice of the flaming trash dumpster, sticks their unprotected face into smoke from unknown contents, shrieking for water through fits of coughing and slays the dragon! All because there is a fire, something has to be done, and the firefighter is there to show the fire who is the boss. Too many firefighters who acted without assessing have died in the line of duty. We must recognize the threat impulsivity inserts into situations and abide by two axioms: "Think then Act," and "Slow is Smooth, Smooth is Fast."

The next two attitudes, invulnerability and machismo, are closely tied to impulsivity. There is a chicken-versus-egg quality to all three. The attitude of invulnerability leads one to believe that, "It can't happen to me." Firefighters with this attitude tend to take unnecessary risks. When they survive, they point to their survival as justification that their actions were the right thing to do. Weary guardian angels and dumb luck would probably be the more appropriate factors to recognize. The job of firefighting is not without risks. However, team members with the invulnerability complex jeopardize the entire team.

Machismo arguably causes more fireground injuries than any other factor. The fire service traditions of "Show me what you got, kid" and "I can do anything you can do, better" have been the hallmarks of fire station life for decades. The trend toward a more diverse fire service has pushed the bar of machismo or proving oneself even higher. Falling into the traps of invulnerability and machismo are self-destructive personally and professionally, period.

Resignation. The mention of the word in fire service circles conjures up the antipathy of what firefighting is all about. However, firefighters displaying the resignation attitude believe they cannot make a difference.

Resignation is the Yin to impulsivity's Yang. The resigned firefighter leaves all decision making to others, even acquiescing when he knows an action is too risky. He just wants to get along and not make waves, regardless of the cost.

Pressing is the attitude that can best be associated with the dumpster fire that is dispatched just as the roast is coming out of the oven. Crews race to the scene blowing traffic lights, leave the SCBA on the rig and gloves in the coat pocket, extinguish the fire quickly and race back to the station to catch at least one piece of roast beef before it can be more appropriately deemed Grade A leather upper. The crew of our fictional pumper achieved goal attainment in the wake of critical judgment errors in time. The guardian angels and dumb luck will sooner or later submit their retirement papers, leaving firefighters exhibiting the pressing attitude to their own demise. Pressing ultimately results in mistakes, injury and death.

Tony Kern coined the phrase "air show syndrome" to describe a hazardous attitude that insidiously finds its way into every fire department. You may already recognize this attitude as "We've done this before and nothing happened, chief," or "They always do it this way on B shift, cap." Some fire service members become complacent about the dangers of the job after surviving close calls. They feel the need to push the envelope a little further each time or given the chance to perform (e.g., featured on a media news report or documentary) and exhibit behaviors that are akin to aerial daredevils. Such behavior may result in tragedy as it sometimes does for the aerial daredevil.

Several years ago, the Discovery Channel aired a documentary about a fire company in a metropolitan fire department. One of the companies spotlighted responded to a fire in a row house. The company arrived on the scene and ran to the rear of the house with a hoseline from another engine. The fire was in the basement, and the spotlighted company had a good shot at the fire as they positioned at the threshold of a basement door, except for one significant point: companies that had entered from the front of the house were already hitting the fire. A narrated voiceover dramatically described the action as the company officer warned the firefighter on the nozzle to stand back. The firefighter (not wearing SCBA, gloves or protective hood) replied that he was okay, protected by a draft. The firefighter also added that the crew from upstairs was pushing the fire on the crew at the basement door. The narrator noted that the basement door crew was at "serious risk." Seconds later a huge cloud of steam burst from the basement door, enveloping the basement door crew, burning the nozzleman (who by this time had removed his helmet to don his SCBA). The crew retreated from the threshold, momentarily stunned. They then pulled their hoseline around to a side window (also billowing clouds of steam and smoke) and made another attempt to enter the basement. The engine crew upstairs continued to fight the fire. Driven back by intense steam, the basement door crew finally gave up on entering the basement. The injured firefighter sought medical treatment (reluctantly under orders said the narrator) and was off duty for two shifts. A classic example of Airshow Syndrome was captured for posterity.

# Fighting the Feeling

The hazardous attitude behaviors spread like a viral infection. Human behavior specialists who have studied the effects of the infection also have identified antidotes to the dangerous acts resulting from the hazardous attitudes. The antidotes require a perpetual vigilance on the part of all personnel. Simply put, the cure for the infection is as simple as consciously reversing the hazardous attitude. The "Student Pilot Judgment Training Manual" advocates memorizing the antidotes to protect one's self (and those around) from catastrophe.

## Antidotes to Hazardous Behaviors

| Hazardous Behavior | Antidote |
|---|---|
| ANTI-AUTHORITY<br>"Don't tell me." | "Follow the rules. They are usually right." |
| IMPUL SIVITY<br>"Do something – Quickly!" | "Not so fast. Think first." |
| INVULNE RA BILITY<br>"It won't happen to me." | "It can happen to me." |
| MACHISMO<br>"I can do it." | "Taking chances is foolish." |
| RESIGNATION<br>" What's the use?" | "I'm not hopeless. I can make a difference in my world." |
| PRESSING<br>"Let's hurry up and get this thing done so we can go home." | "If a job is worth doing, it is worth doing right the first time." |
| AIRSHOW SYNDROME<br>"I am going to look so good. Look at me." | "Let's get the job done right." |

Diehl, Alan, Ph.D., de Bagheera Buch, Georgette, Ph.D., Livak, Gary Spencer, authors, The Student Pilot Judgment Training Manual.

# DECISION MAKING

A three-member engine company arrives at the scene of a working fire in a four-story multi-family dwelling on a raw, rain-swept afternoon. Fire is evident on the second floor, extending rapidly to the third. Department SOPs call for the engine to lay a supply line from the nearest water supply and initiate fire attack. As the engine pulls up to the hydrant, agitated occupants run up to the pumper and yell that there are people trapped on the top floor and people jumping from the third floor. The rest of the assignment is en route, but the hands on the arrival clock seem to be moving counterclockwise. What should the crew do, attack the fire or perform rescues? Should the officer skip the layout and blitz the fire with the deck gun or pull the pumper out of the way and use its ground ladders to pluck as many people from the building as possible while the fire extends into the attic space and threatens more occupants? Should the officer establish command while the other two firefighters work, or would it be better to work as a three-person team to accomplish fire attack or rescues? Is there a "right" decision?

Decision making can be divided into two general categories—life threatening and non-life threatening. Non-life threatening decisions are typically made when a decision maker has time to evaluate options in an unhurried manner and chooses the best option. Life-threatening decisions do not offer such leisurely reflection.

Making decisions, regardless of threat, depends on four factors: information, experience, knowledge and urgency. Making rapid, correct decisions on the fireground requires that the information avalanche and information chasm situations faced by fireground officers be rapidly processed and formulated into an action plan. Klein found that fireground officers made decisions during fire combat by using a unique adapted behavior. Robbed of the ability to fully analyze all options during working fire conditions because of time compression, fireground officers defaulted to previous experiences (known as "pattern matching") of similar situations to plot courses of action (Gary Klein, 1995). Klein also discovered that fireground officers often select the first decision that comes to mind, virtually eliminating any analysis. This method of making decisions is the widely

CREDIT: JOHN TIPPETT

recognized recognition primed decision-making model.

The fireground officers of the '60s and '70s, officers whose decision making capabilities were formed under actual fireground situations, have rapidly faded from the ranks. Today's fire officers are now arriving at incidents that they literally have never seen before with perhaps no knowledge of methods or techniques to mitigate the emergency. They are facing fire dynamics conditions far more intense than their predecessors faced, and other situations (e.g., mass violence incidents), that were incomprehensible to previous officer generations. The urgency factor is still present. However, this urgency factor, in some cases self-imposed, and clouded by compulsion to act, illusionary superiority and cognitive bias, affect the decision-making process.

Dr. Sabrina Cohen-Hatton, Chief Fire Officer of the West Sussex Fire and Rescue Service (UK) has spent twenty years studying fire officer decision making and developing strategies to help officers make better decisions under stress. Her research revealed that 80% of decisions made by firefighters were due to gut instinct, and 20% were analytical. Her groundbreaking research revolutionized how fire officers in the United Kingdom approach the critical decision making process at challenging incident scenes. Dr. Cohen-Hatton's seminal work addresses the hazards of confirmation bias and decision paralysis (or decision inertia) and offers two potent strategies that ensure officers and commanders are making the right decisions at the right

time for the right reasons. The first strategy is employing intense, in context training. Given the unpredictability of accumulating actual incident experience, realistic, in context training has proven to be a model way to build an officer's confidence, command presence, and decision making. The second strategy is using "decision controls." The decision controls process involves asking three questions once a decision is made to improve situational awareness and confidence that the decision is the right one for the moment. The three questions are:

- What are we trying to achieve? (Goals)
- What do we expect to happen? (Forecast)
- Do the benefits outweigh the risks? (Peril Ratio)

Refer to the bibliography in this manual for more information on Dr. Cohen-Hatton's work.

As humans we are all prone to make mistakes. Marcus Tullius Cicero (106-43 BC) astutely noted this flaw in our character with his statement, "to err is human." Mistakes typically fall into two categories, omissions and commissions. Omissions are unintentional. They occur when the decision maker misses a step in a procedure (e.g., skips over turning on the SCBA cylinder during a donning drill), mixes up the steps in a procedure or order (e.g., transposing two digits in a telephone number) or cannot remember the steps in a procedure (e.g., "Was it pull up the protective hood first then don the SCBA facepiece or don the SCBA facepiece and then pull up the protective hood?"). Commissions are deliberate actions that result from misapplication of an accepted rule/policy/procedure (the captain of the SS Grandcamp battening down the hatches to control a fire in a hold full of ammonium nitrate while the ship laid at anchor in Texas City, 1947), lack of knowledge about the gravity of a situation (Kingman, Ariz. firefighters attempting to extinguish a burning propane tank with limited water supply, 12 firefighters killed), purposely violating policy (e.g., failing to buckle a seat belt) to save time or defending freelancing activity on the fireground (indiscriminate, uncoordinated ventilation).

**Were you Accidentally Successful or Intentionally Successful at Your Last Emergency?**

**How Do You Know?**

Whether unintentional or intentional, mistakes have consequences. When the consequences are inconsequential, there is a tendency to overemphasize how little impact a decision-making mistake played in an outcome versus seeing the outcome as dodging a calamity. Failing to deeply explore whether the decisions made at an incident contributed to an accidental success versus intentional success can literally make the difference between life and death.

The key in either scenario is taking a hard look at how decisions were made. Whether instinct/experienced based, or linear based, leaders are best advised to remain open to information from all angles.

CREDIT: JOHN TIPPETT

# The CRM Contribution

**Crew Resource Management provides work groups with a framework to process all information and formulate action plans more effectively. The leader retains ultimate authority but includes crew input for better outcomes.**

Crew Resource Management provides teams with a framework to process all information and formulate action plans more effectively. The leader retains ultimate authority but processes inputs from the crew to render more efficient and correct decisions. CRM teaches leaders to be less the "ultimate authority" and more the "open-minded leader." Leaders versed in CRM recognize the limits of their ability (to err is human) and encourage their subordinates to participate in the decision-making process. Subordinates versed in CRM recognize the importance of providing their leader with as much pertinent information as possible to assist their leader in making the best decision possible, regardless of the consequences.

Incident scene decisions are initially made more in a vacuum, than information rich. As responders get closer to the incident scene, more things come into focus, but uncertainty still prevails. CRM's primary tenet seeks to fill that void by requiring use of all resources to their fullest potential to prevent mistakes and promote success. Adopting this tenet as a daily mantra will enhance decision making on all levels. Fire service leaders will recognize and appreciate the value of the additional eyes, ears, opinions, experience and knowledge of their subordinates. Subordinate personnel will improve their decision-making skills as they are asked for input.

Given the randomness of when and what type of emergencies a fire department will encounter, fire officers from company officer to chief of department need to substitute real life experience with realistic, situational training that taps the same decision-making processes as real world challenges. Command and control training opportunities exist throughout the United States. These training situations teach risk/ benefit analysis, promote naturalistic decision making and give officers confidence in themselves.

Learning how we make decisions and practicing successful decision-making models will improve a leader's skill. Klein and Cohen-Hatton have proven this concept. One additional process to offer emerged in the 1970s as fire departments were grappling with the emerging hazardous materials problem. The late Dr. Ludwig Benner (1927-2021), considered the father of modern HAZMAT decision making, created the "D.E.C.I.D.E" model, a six-step linear process for reaching a decision in a conscious, oriented manner. Using Benner's model provides leaders with a proven method for analyzing a situation, weighing options and taking appropriate action when conditions require a measured approach. D.E.C.I.D.E. is still relevant today, offering another tool to improve an officer's approach to information starved situations.

### The "D.E.C.I.D.E." Model

- **D**etermine the problem.
- **E**valuate the scope of the problem.
- **C**onsider available options for mitigating the problem.
- **I**dentify the most appropriate option.
- **D**o the most appropriate option.
- **E**valuate the effectiveness of actions

# OODA Loops: Operating at a quicker tempo to defeat any adversary

There is no arguing decision making under duress garners intense scrutiny because of the impact it has on situational outcomes, and in some cases, lives. Benner's concept was developed to get responders ahead of the disaster curve, maximizing life safety, incident stabilization and property conservation efforts. Underestimating how the human mind works under the stressors of intense and overwhelming stimuli and time compression is crucial to building organizational resilience for emergency providers.

We are constantly on the lookout for methodologies and strategies to keep us one step ahead of disaster. CRM offers one such tool. Interestingly, there is a philosophy fashioned by a well-recognized colonel in the U.S. military, U.S. Air Force Colonel John Boyd, that offers an additional opportunity to stay one step ahead of calamity. Boyd's philosophy is known as "OODA Loop," Observe, Orient, Decide, Act, is outlined below.

John Boyd was a legendary fighter pilot and instructor who came of age as the Air Force emerged as a standalone branch of the U.S. military. He was commissioned as a second lieutenant and saw service in the Korean War. Widely revered for his innate ability to defeat any enemy, Boyd became a legendary instructor at the Air Force's fighter training base, Nellis Air Force Base. His ability to think faster, act quicker and create chaos in the mind of his enemy earned him enormous respect within the fighter community. Boyd was renowned for his ability to defeat any fighter pilot he engaged with in forty seconds. Boyd institutionalized his philosophy and then spread it throughout the Air Force and beyond. The concept of OODA Loop is lionized as a process for winning conflict.

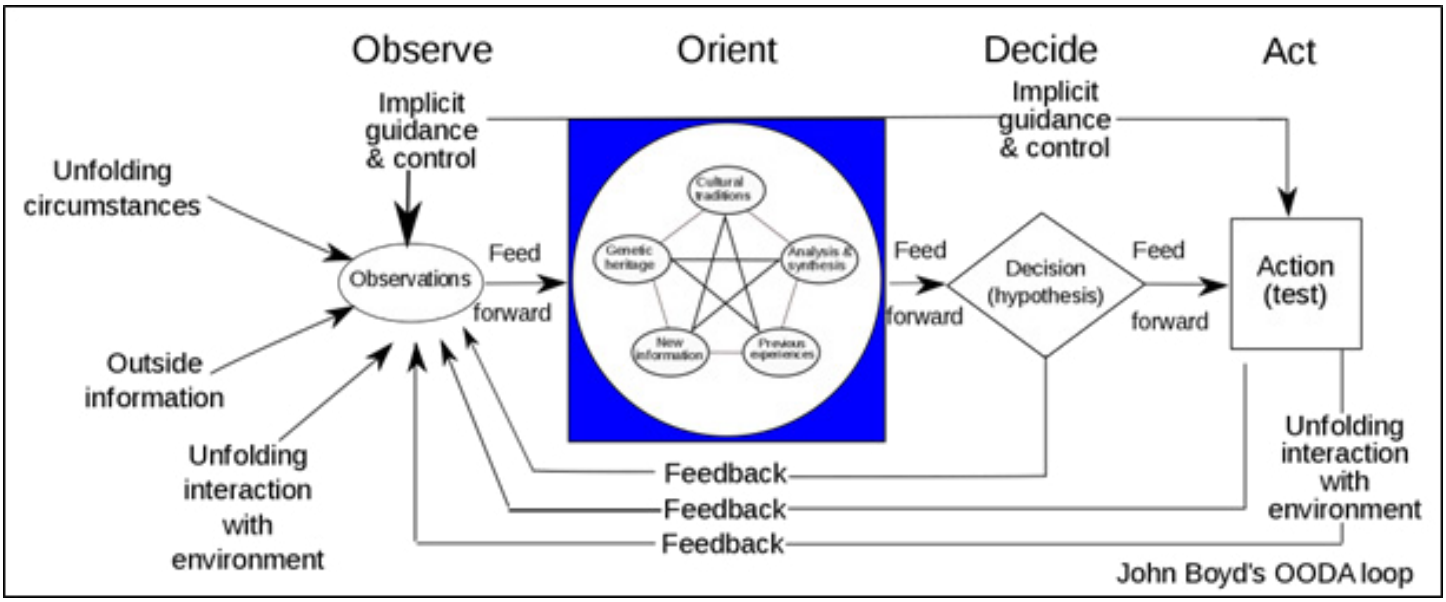
OODA Loop is a decision cycle. The cycle is a repetitive process of four factors: Observe, Orient, Decide, and Act. Developed as a military strategy applied to the fast-moving whirl of air to air combat, it has application to virtually any conflict situation. Boyd postulated that during combat, the combatant who could get inside his adversary's mind (or action plan) and disrupt the plan, would emerge as the victor.

**Colonel John Boyd, U.S. Air Force**
**1927-1997**

You may ask, "What does this have to do with firefighting and crew resource management?" The answer is, in one word, "plenty." Applying Boyd's tenet to the emergency scene is not as far a stretch as might first appear. Firefighting involves conflict, but the "adversary" isn't human. Consider fire, time, uncontrolled bleeding, rising floodwaters, and wind. All these phenomenon and conditions are considered adversarial in the world of emergency services. Making the connection between and "enemy" and the adversaries encountered on the emergency scene takes the military concept of OODA Loop as a battle strategy and readily transfers it to a usable decision-making strategy for the emergency scene.

Boyd's intent was to create chaos in the mind of the adversary. To create chaos, one has to think faster than the adversary (or be one step ahead as Benner postulated). In Boyd's world, an unanticipated maneuver disrupts the projection of how an enemy expects the situation to unfold and turns the situation to one's favor. Boyd postulated that whoever oriented first to a rapidly changing situation would have the upper hand. Conceptually, observing one's surroundings and "orienting" to the situation creates a fertile field for deciding what to do, then acting before your enemy recognizes what is going on. In air-to-air combat, Boyd developed a signature move that earned him the nickname "40 second Boyd." Boyd would lure an adversary into thinking the adversary had the classic advantageous firing position on Boyd's tail. Boyd would throw on the plane's brakes, forcing his opponent to overfly Boyd. When the adversary passed over, Boyd would align his aircraft on the adversary's tail and obtain the classic "shoot down" position the adversary had just seconds before. Boyd knocked adversaries out of the sky in forty seconds, a record established in the mid-1950s that still stands today. Boyd's ability to Observe, Orient, Decide, and Act in a manner faster than his adversary resulted in countless wins in air-to-air combat training. This training translated to victories in actual air-to-air combat in Viet Nam. It wasn't long before the Navy and other air forces were clamoring for Boyd's training. To this day, Boyd is a legend in the air-to-air combat discipline. In fact, Boyd's concept is vividly portrayed in the 1996 Academy Award winning film "Top Gun." The scene where Tom Cruise's character Lieutenant Pete "Maverick" Mitchell "puts on the brakes" of his F-15 during training and forces an opponent to overfly him is the classic Boyd maneuver.

John Boyd was a visionary, and six-dimensional thinker. He readily recognized the concept of OODA Loops being applied to situations outside of mortal combat and began teaching the concept outside of martial strategy. Boyd's approach to conflict revolutionized how people viewed disrupting "adversaries" of all types. Emergency service providers studying and adopting Boyd's OODA Loop philosophy strengthen the likelihood of good outcomes in the same way that Boyd gained the upper hand against his adversaries. Boyd's theory of "whoever can handle the quickest rate of change is the one who survives" became engrained in fighter pilot mentality.



## Operating at a quicker tempo

"Generating a rapidly changing environment – that is engaging in activity that is so quick it is disorientating to the enemy – inhibits the adversary's ability to adapt and causes confusion and disorder that, in turn, causes an adversary to overreact or underreact."

Whether fire is blowing out of a second story window, or a patient has just lapsed into cardiac arrest, a rapid, well-choreographed action is the key to a successful outcome. Translating Boyd's OODA Loop to the emergency scene is a direct application. Emergency crews arriving at the scene of a rapidly changing environment are compelled to act and act quickly. However, if they fail to orient more rapidly than the situation is changing, they will be controlled by the situation rather than control the situation.

So, the emphasis is on changing the tempo of the event to gain the advantage. Practically speaking, this translates to observing conditions on arrival at a structure fire and initiating a transitional attack to check the fire, making entry more tenable and reducing the likelihood of a fatal flashover. On an EMS call, initiating immediate CPR and applying an AED when a patient is determined to be in cardiac arrest interrupts the spiral to death and saves the patient's brain function. When confronted with an arterial bleed, rapidly applying a tourniquet stops the bleed and prevents death. In the wildland environment, observing a shift in the weather results in rapid orders to move crews out of harm's way. The list of how orienting changes outcomes on the emergency scene is endless. Boyd's emphasis on orienting first and constantly to dynamic situations is a sound practice for crews to gain the upper hand on any adversarial situation. Orienting translates to saving civilian and responder lives and preserving savable property.


CREDIT: JOHN TIPPETT

# SITUATIONAL AWARENESS

CREDIT: : FAIRFIELD TOWNSHIP (OH) FIRE DEPARTMENT

The station chef is in the firehouse kitchen preparing dinner. Several pots are going on the stove, and he is talking to the battalion officer trying to get off next shift. Temperatures continue to rise in the pots, and the latent heat of vaporization point is reached while the cook has his back to the stove confirming his leave plans. Pots begin boiling over faster than the cook can drop the phone and reach the stove. The night's dinner is flowing across the stove and onto the kitchen floor. The cook's epithets and clouds of steam stream into the day room alerting the rest of the shift. The cook's failure to maintain situational awareness sends the shift dejectedly to the watch desk in search of the carryout menus.

Disaster (small or large) is the result when situational awareness is lost. Situational awareness (SA) is an internal process that goes on constantly, much like size-up. Like size-up, situational awareness must be updated constantly through the principles of observation, communication, and borrowing from Boyd, orientation. The dynamic, fluid emergencies firefighters respond to require that firefighters always maintain the absolute highest state of alertness and attention.

Since firefighters are human and subject to the same frailties as the rest of the general population, the loss of situational awareness does occur. The nature of the firefighter's work requires that they remain cognizant of the signals of inadequate or declining situational awareness. When situational awareness is maintained, incidents are mitigated smoothly, and injuries are virtually eliminated. The opposite is true when situational awareness is ignored.

The loss of situational awareness can be attributed to eight factors. Remembering these factors arms firefighters with another weapon to stave off mistakes. Remaining vigilant for the appearance of these factors and taking action to arrest their influence when they occur gives firefighters an advantage over the catastrophic, life-altering incident.

Situational awareness resides in three levels: awareness (or perception), comprehension, and projection. The very first level sets the tone for the rest of an encounter. Awareness, or perception, is the state of fact gathering. In this state, the stimulants assaulting our senses are

being collected. It is at this point where a situation has its best chance of being resolved…or bungled. If our data gathering is flawed, what we perceived is not going to be what is really occurring. The adage of "perception is reality" conveys that what we perceive is happening is actually happening. However, if one is not in tune with the surroundings due to one of the eight SA loss factors, disaster won't be far behind..

SA loss factors, a lack of good information, unfamiliar with what is unfolding, suffering from illusionary superiority or unrestrained confirmation bias, and ignoring input from others, create links in the disaster chain that connect and head to calamity. Clear, concise and complete communication and observation are essential to make reality and perception equivalent enough to be considered identical. The best way to avoid losing situational awareness is to be alert for the loss of situational awareness indicators and be open to input from the rest of the crew. There is no greater defense against the loss of situational awareness than perpetual vigilance and constantly orienting.

The second level of SA is comprehension. This phase brings the information gathered at the awareness/ perception level into focus where the officer can start understanding what has been collected. This phase begins the alignment of what the officer perceived to be going on with what is actually happening. Another way to define comprehension is "sense making." This is a critical juncture in SA and decision making, since this intersection brings the officer's confirmation bias into play with the facts of the incident. Self-aware officers will be on guard for the pitfall of confirmation bias here, and ensure they are in a state of mind to be objectively evaluating what is going on. This is an excellent point in the process of assessing if one is properly orienting to the situation and ensuring any goals established are relevant and achievable.

Projection, or forecasting is the final level of SA. The information has been acquired and distilled; projection determines what might happen next. At this level, the officer is making a prediction of the success of their operational plan, or if another course of action is needed.

Situational awareness, the concept of identifying what is going on around you, is critical to the decision making process of incident management. Officers cannot develop a cogent plan, properly assess risk, or resolve an incident without SA.

## Situational Awareness Loss Indicators

- **Ambiguity** – Open to more than one interpretation or unclear.
- **Distraction** – Attention is drawn away from the original focus of attention.
- **Fixation** – Focusing attention on one item excluding all others.
- **Overload** – Too busy to stay on top of everything.
- **Complacency** – A false sense of comfort that masks deficiencies and danger.
- **Improper procedure** – Deviating from SOPs without justification.
- **Unresolved discrepancy** – Failure to resolve conflicts or conflicting conditions.
- **"Nobody fighting the fire."** – Self-explanatory.

# WORKLOAD MANAGEMENT

The advent of the 10-digit telephone number pushes the average human brain to the limit of its recall ability. We marvel at those individuals who are great multitaskers. As we undertake more work without shedding other work, our ability to perform each assigned task with equal efficiency begins to decline to the point of inefficiency. Your ability to comprehend the previous sentence is a case in point. You may have had to read the sentence twice to understand its meaning. Sentences more than 20 words tend to overload our ability to understand the meaning with one read. We compensate by reading the sentence a second time and breaking the sentence into more manageable parts: workload management.

Several studies conducted by Dr. Robert Helmreich (University of Texas) concluded that commercial airline pilots believed that they were immune to overload. Part of a pilot's training and indoctrination creates the development of a self confidence that leads pilots to believe they "can do anything." Helmreich discovered, however, that a pilot's performance under stress was not always as good as the pilot perceived. Some pilots failed to recognize they were overloaded and made mistakes that were not corrected. Dr. Cohen-Hatton's work also identified that incident commanders under pressure could reach overload if they failed to manage the myriad of challenging incident scenes.

Workload management is a system used by effective leaders to divide a given task into equal parts to ensure no one worker is overloaded, including the leader. Overloaded workers make mistakes. The mistakes range from a simple clerical error to loss of life. Workload management:

- Promotes teamwork by emphasizing the interdependence a crew has on each other
- Provides an increased margin of safety as a result of a crew's balanced workload
- Encourages teams to develop strategies for handling work overload.

CREDIT: JASON CAGE

One automatic aid agreement between multiple fire departments provides an example of workload management for the multiple activities involved in extinguishing a structure fire effectively and safely. This department dispatches four engines, one ladder, one heavy rescue, three command officers, and an EMS unit to a residential structure fire. The first engine establishes water supply and is the primary attack engine. The second engine completes the water supply and pulls a back-up line. The third engine fills out rapid intervention. The fourth engine provides a Charlie Side (rear) update and pulls a third handline for exposure protection. The ladder and rescue take care of search, softening the structure, ventilation and utility control. The first arriving battalion chief takes command from the first engine. The second chief takes accountability, building out the command team. The third chief fills the role of safety officer. The EMS unit provides EMS standby and initial rehab.

Each unit fills a pre-determined role to ensure identified critical tasks are covered and crews are not forced to pick one critical function over another. Should the incident exceed the response's capability, the incident commander can call additional resources of all types in a sliding scale of groups to keep the workload manageable. Additional crews stage nearby and move to an "on-deck" status so they can be deployed in a timely manner. As span of control is expanded, additional chief officers are put in group or division supervisor positions to keep the firefight organized, controlled and safe.

# TASK ALLOCATION

"Engine 1, take a saw off of Truck 20 and vent the roof." This order can turn out one of two ways based on a variety of factors. If Engine 1 and Truck 20 are housed in the same station, joint drills on roof ventilation using Truck 20's equipment may make the order seamless. If Engine 1 is from Department A and Truck 20 is from Department B, and neither has seen each other before, the outcome may range from less than efficient to downright unsafe.

Getting the right person for the right job conveys a message about the importance of knowledge, skills and abilities. We have all suffered the frustration of dealing with an individual ill-prepared to perform a function. The reasons the individual is performing poorly are wide ranging and varied. The bottom line is people prepared for a task perform far better than an individual who is not prepared. Under the concept of CRM, leaders should have a deep working knowledge of the skills their direct reports have, the weaknesses they have and develop strategies for maximizing the strengths and minimizing the weaknesses.

CREDIT: DEEP CREEK FIRE


CREDIT: GULFPORT (MS) FIRE DEPARTMENT

# ERROR MANAGEMENT & STANDARDIZATION

The fire service is in the business of error mitigation—that is, managing the mistakes of others. We are known as the "last line of defense." The drawback to the service's approach to date is the "last line of defense" mentality has caused us to pay less than the necessary attention to managing our own errors. Since errors are a fact of life (and the reason our service exists), it stands to reason that minimizing our own errors would improve safety. Improving safety translates to reduced deaths and injuries. Reductions in deaths and injuries translate to a more effective workforce. Sounds simple enough. But enter the human factor and the fire service's history of "jumping to a concussion" (an old life net drill adage). Approximately half of all firefighter line-of-duty deaths can be attributed to error. Few firefighters deliberately enter a burning structure, swift water event, confined space, hairpin turn or any other hazardous situation with the intent of doing themselves harm. Some portion of the other 50 percent (death from stress) can be arguably attributed to error: that is failing to take care of oneself (i.e., poor physical conditioning, poor diet, smoking, skipping physicals).


CREDIT: BATH TOWNSHIP (OH) FIRE DEPARTMENT

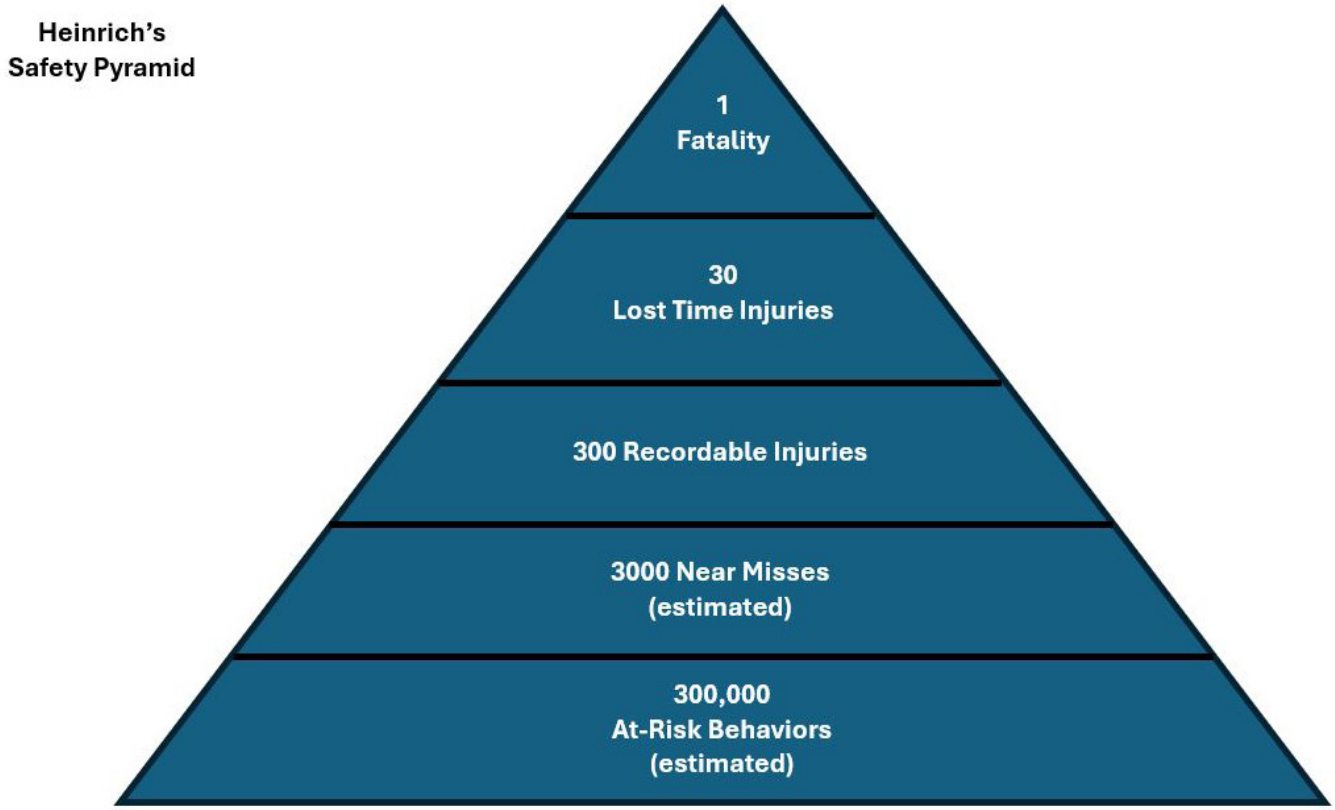
The safety pyramid, originated by H. W. Heinrich in the 1930s and modified in recent years, illustrates a sobering presentation on the impact of errors in the workplace. While we focus on the singular, catastrophic fatality event at the top of the pyramid, we fail to see the bigger picture of how prevalent errors are in the world, and how many opportunities there are to reduce fatalities. Dr. Robert Helmreich, Ph.D., a noted human error specialist considered to be one of the founders of Crew Resource Management, developed an Error Management Model that provides a framework we can use daily to attack the staggering numbers found in the safety pyramid.

The first step, avoid, is the step that offers the greatest number of opportunities to prevent error with the least risk but cannot always be applied in emergencies. Error avoidance can be actively practiced by following six tenets outlined by the airline industry.

- Maintain a high level of proficiency
- Follow SOPs
- Minimize distractions
- Plan ahead
- Maintain situational awareness
- Effectively use all resources.

Three of the six steps—maintaining proficiency, following SOPs and planning—have been part of the fire department drumbeat for generations. Minimizing distractions has slowly made inroads in the last decade.

## Heinrich's Safety Pyramid



# Helmreich's Error Management Model


Helmreich's Error Management Model

Maintaining situational awareness is new terminology for the fire service but can be likened to a crusty mentor's admonishment to "pay attention" at all times. Effectively using all resources involves using CRM. Avoidance is the least labor-intensive error management action that results in the most effective error management effort. Doing your job and doing it well leads to a subconscious error avoidance strategy.

To err is human, ergo mistakes will occur. Avoidance will not always be successful because the fire service mission is to take action to minimize disaster, and humans fulfill the role of firefighter. The fire service typically arrives at incidents and initiates the final step in someone else's error management model, mitigation. But within the service's own error management model, trapping errors follows avoidance. Once an error occurs, all efforts must be exerted to keep the error to its least damaging level. The second step in error management is accomplished through creating layers of redundancy. Redundancy provides a series of "safety nets" or "barriers" designed to keep an error from escalating into a catastrophe. These layers of redundancy mirror the six actions outlined in error management.

The first barrier is maintaining a high level of proficiency. Few fire departments spend more than five percent of their total work time handling emergencies. Therefore, a significant portion of a department's productive time needs to be devoted to training and preparation. The late Vince Lombardi's statement "You will play like you practice" is as true for the fire service as it is for the NFL. Well-trained and proficient firefighters make fewer mistakes.

A solid set of well-developed, tried-and-true standard operating procedures cannot be given short shrift. SOPs provide the usual course of action for crews to follow. The advantages of good SOPs are well known. The SOPs contribution to error management lies in their consistency and standardization. The predictability of knowing where each company will be on a structure assignment reduces the potential for duplication of effort and problems such as opposing hoselines. Procedures cannot be created for every situation, however. Even the best-designed systems can be circumvented because human fallibility is a given. The ill-timed venting of a structure before hoselines are in position is a good example.

Minimizing distractions and maintaining situational awareness are barriers that also contribute to minimizing error. A fire service crew, like its aviation and military counterparts, cannot afford to be less than fully engaged and focused on its mission. Distractions diminish operational readiness and contribute to a loss of situational awareness. The airline industry's crash history is replete with cockpit recordings that indicate crews


CREDIT: JOHN TIPPETT

were not focused on flying the plane. In one case a pilot and co-pilot were engaged in a casual discussion of the attributes of a particular flight attendant during their pre-flight check. When the plane attempted to take-off, the flaps were in the wrong position and the plane crashed, killing all aboard. The flight crew's distraction and loss of situational awareness were deadly.

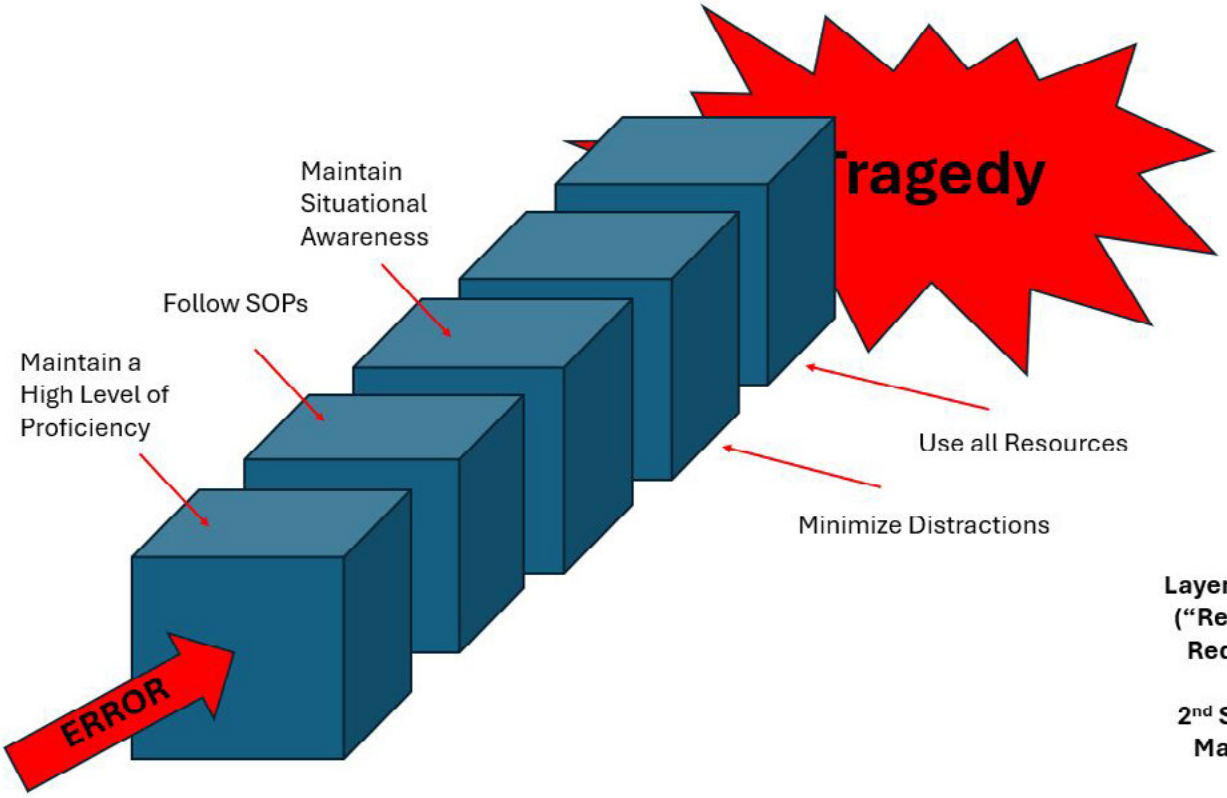
When errors escape avoidance and holes in barriers allow errors to penetrate the layers, mitigation is the last-ditch effort available to head off a catastrophic event. As noted above, the fire service is the mitigating force in other people's error management systems. But who is the mitigation component in the fire service error management model? The answer is the same component trained to avoid and trap the errors of others—members trained in CRM. Fire department personnel trained in CRM are prepared for all eventualities. They strive daily to minimize errors through avoidance and trapping but also are pre- pared to implement mitigation efforts when necessary. The department freely overlaps all three steps in the error management model to ensure the consequences of errors are minimized. Mitigation requires that firefighters be vigilant and stay focused. Being vigilant and staying focused require communication, workload management, decision making and teamwork. How do we know these efforts work? Ask the U.S. Coast Guard. Since implementing CRM in the 1980s, the Coast Guard has realized a 74 percent reduction in injuries.

CREDIT: SCOTT YURCZYK, SEATTLE (WA) FIRE DEPARTMENT

# So what are the keys to error management?

1. **ACKNOWLEDGE** that we are error prone. This does not mean errors are an acceptable way of life, just that we should be prepared for them to occur.
2. **Maximize BARRIERS.** Keep as much redundancy in your operations as possible. Minimize task loading by using SOPs and CRM. Recognize that reduced staffing may impair your ability to recognize errors by up to 50 percent.
3. **COMMUNICATE** risks and intentions. Speak up about anything that reduces your ability to detect errors or increases your chances of making errors.
4. **Follow the SOPs.** A NASA/University of Texas study found that pilots who intentionally ignored an SOP were 1.6 times more likely to commit a second error.
5. **Is this action SENSIBLE?** Take a moment to think with your analytical head, not your emotional heart. Some sample self-questions might include: What is to be gained from this interior attack? Do I have adequate resources at this time to commit to holding this fire line? Give strong consideration to the U.K.'s "decision controls," developed from Dr. Sabrina Cohen-Hatton's work: "What are we trying to achieve?" (Goals), "What do we expect to happen?" (Forecast), "Do the benefits outweigh the risks?" (Peril Ratio)

# Layers of Defense ("Redundancy") Reduce Errors




**Layers of Defense ("Redundancy") Reduce Errors**

**2nd Step in Error Management**

# APPLYING CRM AT YOUR FIRE DEPARTMENT

You have now been introduced to Crew Resource Management. Where do you go from here? If you return to your department and issue a decree that from this point forward everyone will practice CRM, you will likely find CRM hanging in the closet next to the three-quarter boots, play pipe and aluminum helmets. CRM is a lifestyle change for everyone in the chain of command. The entire department must be brought on board for CRM to be effective. One of the greatest advantages CRM presents to the masses is respectful empowerment. CRM insists that everyone has a voice and an input that must be valued and assessed. CRM also reinforces that leaders have the ultimate authority in decision making but encourages them to obtain input prior to making decisions. CRM does not advocate leaderless groups, or call for the overthrow of the chain of command. Rather CRM is a "force multiplier" (Lubnau, Okray) that enhances a department's operation because it sets the stage for thousands of pairs of eyes and ears to look out for errors and improve safety.

CRM must be taught to everyone in the department, from first- day rookie to last-day veteran. As training is undertaken, keep your ear to the wall and see if anyone speaks up about how CRM contributed to avoiding, trapping, or mitigating an error. Successful CRM programs have been enhanced with the "real life experience" of someone who successfully used it. Captain Lloyd Haines and the crew of United Flight 232 may be a little abstract for us, but when Captain Johnson of Engine 14 stands before the department and says, "We avoided a catastrophe on this foggy morning's car crash on the interstate. If my crew and I hadn't received CRM training, we would have never..." a strong link is created.

This manual has been created to open the door to CRM training. But remember, CRM is more than just a one-time presentation. Success will depend on full acceptance, constant reinforcement early on, and frequent review for CRM to become the prevailing department culture. There are several excellent CRM instructors and programs available for presentation to your department. Select the best CRM program for the culture transformation you are seeking, and train everyone in the department to use it.

The success of CRM cannot be disputed. The aviation industry is on its fifth version, and now considers the tenets an ingrained mindset. The Coast Guard and Air Force have also validated CRM with a successful 30+ year history. The results are indisputable. And if members of your department can't make the connection between firefighters interacting and interactions in the cockpit, operating theater, or battlefield, there are modified versions of CRM like the Firefighter Training Initiative produced by the Illinois Fire Service Institute that may be adaptable.

Applying the current death and injury rate, 2,425 additional firefighters will die and 2,375,000 will suffer injuries if the fire service takes 25 years to fully implement CRM. Is that timeline, death rate, and injury rate acceptable? Make a bold stroke at reducing firefighter death and injury. Champion adopting CRM in your department.

CREDIT: MANASSAS (VA) FIRE DEPARTMENT

# APPENDIX I: CREW RESOURCE MANAGEMENT (CRM) SAMPLE INSTRUCTOR OUTLINE

**Note: This sample instructor outline is designed to be expandable. Presentations may range from 30 minutes to four to six hours depending on use of exercises and case studies. Instructors will need to develop a learning objectives slide that reflects the depth of subject. Learning objective slides should reflect an emphasis on exposure to:** History of CRM, Components of CRM, and Benefits of CRM.

## 1. History of Crew Resource Management

- **a.** In 1976 the aviation industry recognized human error was the primary cause in approximately 60-80 percent of aviation accidents.
- **b.** Technological "fixes" only reduced accidents until the next human error.
- **c.** A new approach to preventing disasters was born when the industry looked at ways to "fix" the primary cause—human error.
- **d.** Originally called "Cockpit Resource Management."
- **e.** Title changed to "Crew Resource Management" to incorporate all members of the flight team.
- **f.** Program adopted by the U.S. military in the 1990s.
- **g.** U.S. Coast Guard has realized a 74 percent reduction in injuries and fatalities since implementing CRM.
- **h.** Air disasters have dropped from approximately 20 per year to one to two per year.

## 2. Fire Service Experience

- **a.** Firefighter line-of-duty deaths and injuries have remained relatively static for the last 10 years (97/95,000).
- **b.** Three key elements responsible for firefighter deaths:
  - **i.** Adrenaline
  - **ii.** Over aggressiveness
  - **iii.** Cholesterol
  - \- Chief Bill Peterson, Plano, TX
- **c.** Numerous recent NIOSH LODD reports cited poor decision making as a causal factor.
- **d.** Watershed Fire Service Tragedies Involving Human Factor Errors*

  - **i.** Thirty Mile Fire, Washington
  - **ii.** Worcester, Massachusetts
  - **iii.** Keokuk, Iowa
  - **iv.** Washington, D.C.
  - **v.** Lake Worth, Texas
  - **vi.** Houston, Texas
  - **vii.** Memphis, Tennessee
  - **viii.** Kansas City, Missouri
  - **ix.** Storm King Mountain, Colorado
  - **x.** Oklahoma City, Oklahoma
  - **xi.** Hackensack, New Jersey
  - **xii.** Seattle, Washington
  - **xiii.** Boulder, Colorado
  - **xiv.** Milford, Michigan
  - **xv.** Mann Gulch, Montana
  - **xvi.** Lairdsville, New York
  - **xvii.** Charleston, South Carolina
  - **xviii.** Yarnell, Arizona

***Instructor Note: Select two or three and provide brief overview of event and human factors involved.**

## 3. Human Factor Error Causes

a. Gordon Dupont's "Dirty Dozen"
   i. Lack of Communication
   ii. Complacency
   iii. Lack of Knowledge
   iv. Distraction
   v. Lack of Teamwork
   vi. Fatigue
   vii. Lack of Resources
   viii. Pressure
   ix. Lack of Assertiveness
   x. Stress
   xi. Lack of Awareness
   xii. Norms

b. Regardless of occupation, people perform work.

c. Error causes are consistent for all occupations.

d. LODD error causes fall into five main categories (NIOSH Firefighter Fatality Investigation and Prevention Program)
   i. Lack of Accountability
   ii. Lack of Communication
   iii. Lack of Standard Operating Procedures
   iv. Lack of Incident Management
   v. Lack of Appropriate Risk Assessment

## 4. Crew Resource Management

a. Crew Resource Management (CRM) is a tool created to optimize human performance by reducing the effect of human error through the use of all resources.

b. Resources include:
   i. People
   ii. Hardware
   iii. Information

## 5. Principles of CRM

a. Error management through improved training/skills development in six areas:
   i. Communication Skills
   ii. Teamwork
   iii. Task Allocation
   iv. Critical Decision Making
   v. Situational Awareness
   vi. Debrief

b. Six steps in detail:
   i. Communication Skills*
      1. Six Step Process
      2. Abbott & Costello ("Who's on First" video)
      3. Dominos (exercise)
      4. Paper Tearing (exercise)
      5. Communication Barriers (exercise)
      6. Appropriate Assertive Behavior
      7. Standard Language
      8. SOPs
      9. "Sterile" Cab
      10. Inquiry Skills
      11. Advocacy Skills

***Instructor Note: Select two or all three exercises as time allows.**

ii. Teamwork
   1. Leadership
      a. Authority
      b. Mentoring
      c. Conflict Resolution
      d. Mission Analysis
      e. Teamwork
   2. Followership
      a. Self Assessment
      b. Physical Condition
      c. Mental Condition
      d. Attitude
      e. Understanding human behaviors
      f. Followership Skills
         1) Respect authority
         2) Personal safety
         3) Crew Safety
         4) Accept authority
         5) Know authority limits
         6) Leader success
         7) Good communication skills
         8) Learning attitude
         9) Ego in check
         10) Balance assertiveness/authority
         11) Accept orders
         12) Demand clear tasks
         13) Admit errors
         14) Provide feedback
         15) Adapt

iii. Task Allocation
   1. Know your limits
   2. Know your crew's limits
   3. Capitalize on strengths
   4. Eat the elephant one bite at a time

iv. Critical Decision Making
   1. Recognize problems
   2. Continue to "fly the plane"
   3. Maintain Situational Awareness
   4. Assess Hazards
   5. Assess Resources
   6. Solicit Solutions
   7. Make a Decision!
   8. Rapid Primed Decision Making
   9. Ways to increase decision making skills
      a. Experience
      b. Training
      c. Communication
      d. Preplanning

v. Situational Awareness
   1. "Fight the fire!"
   2. Assess problems in the time available
   3. Gather information from all sources
   4. Choose the best option
   5. Monitor results—alter as necessary
   6. Beware of situational awareness loss factors

vi. Debrief
   1. Check your feelings at the door
   2. Facilitate
   3. Prebrief
   4. Topics
   5. Decorum
   6. Analyze
   7. Operations
   8. Human behaviors

c. A high degree of technical proficiency is essential for safe and efficient operations.

d. CRM alone cannot overcome a lack of proficiency.

e. Technical proficiency alone cannot guarantee safe operations in the absence of effective crew coordination.

f. CRM must be taught to all members of the organization.

g. Team leader retains authority, recognizes benefits of using all available resources.

## 6. Why CRM for us?

a. We have improved technology and still experience preventable deaths and injuries.

b. Parallels between aviation, military, medical industry and fire service errors suggest CRM will work for the fire service.

c. If we continue on the current LODD/injury path, we will experience 970 fatalities and 950,000 injuries over the next 10 years.

d. "If not now, when? If not us, who?"

## 7. IAFC Meetings

a. September 2000—Kick-off meeting

b. June 2001—Recommendations to IAFC Executive Director

c. Goal—Reduce the LODD and injuries caused by human factors by 50 percent within five years of implementation

## 8. Crew Resource Management – Summary

a. A proven, positive change to arrest the effects of adrenaline, over aggres- siveness, and human error on our culture

b. A positive change for our culture

c. For further information, refer to:
   i. *Firehouse* (seven-part article) May-August 2001, November 2001, July 2002, August 2002
   ii. *Fire Engineering*, August 2001
   iii. Go to the Web and type in keywords "Human Factors," "Crew Resource Management," or "Human Error."

# APPENDIX II: CRM EXERCISES
# COMMUNICATION EXERCISES

**When:** Introduce during the "Communications Skills – Six-step process" segment.

**Purpose:** Emphasize the various forms of communication (one-way, limited two-way and open) and the effect of barriers.

**Duration:** Five minutes

**Materials:** One sheet of paper for each participant.

**Instructions:** Paper Tearing

1. Ask for three or four volunteers from class to step forward.
2. Hand each a blank sheet of paper.
3. Instruct the group that they must listen to all instructions carefully, not say anything and keep their eyes closed until instructed to open them.
4. State the following instructions:
    a. Fold the paper in half.
    b. Tear a one-inch square from the lower left corner.
    c. Fold the paper in half.
    d. Tear a one-inch square from the upper right corner.
    e. Fold the paper in half.
    f. Tear a one-inch corner from the upper left corner.
    g. Open your eyes, unfold the paper and hold it up for the class to see.
5. Discuss the reasons for diverse shapes (i.e., barriers to communication—no vision, vague instructions, etc. ).

# Verbal Communications

**When:** Introduce during the "Communications Skills— Standard Language" segment.

**Purpose:** Emphasize the various forms of communication (one way, limited two-way and open) and the effect of barriers.

**Duration:** 15 minutes, three rotations.

**Materials:** One set of 10 matching dominos for each crew (Note: name the crews to relate to the target audience e.g., engine crew, command staff, Hotshot, etc.).

**Instructions:**

1. Divide class into normal company size.
2. Have group select an "officer," "driver," and "firefighter(s)."
3. Give one set of dominoes to each "officer."
4. Have the officer verify that each set contains two sets of five matching dominoes (Identical dot patterns, not color, are important.
5. Have everyone listen carefully and inform them that the rules change for each rotation.
6. Have each officer and driver pair sit back to back so they cannot see each other's dominoes.
7. Instruct the officer to build a domino shape. Each domino must touch the adjoining domino. The final shape cannot be a circle or a straight line. The goal is for the driver to build the identical shape that the officer built.
8. Instruct the officer that he/she may say anything he/she believes is necessary to get the driver to build an identical shape.
9. The driver may not make any sounds.
10. Firefighters may only watch.
11. The other firefighter(s) are observers and may only watch.
12. Advise the teams that they have 90 seconds to complete the exercise.
13. Confirm all teams are ready, announce "go," and start the clock.
14. Call time at 90 seconds and have the officer and driver compare their shapes.
15. Have each crew rotate positions.
16. Repeat Steps 5-8.
17. Instruct the groups: Officers may say anything. Drivers may only say "Yes" or "No." Firefighters may only watch.
18. Advise the group that they have 60 seconds, announce "go," and start the clock.
19. Stop the clock at 60 seconds and have everyone evaluate his/her work.
20. Have groups rotate again. Ensure that everyone is in a position they had not occupied before.
21. Repeat Steps 5-8.
22. Instruct the groups: Officers may say anything. Drivers may say anything. If the firefighter(s) ask about their role, say, "We don't have time to discuss your role. Groups have 30 seconds to complete the exercise–Go!"
23. Call time at 30 seconds and have groups compare work.
24. Ask the class if it is possible to complete the task in 30 seconds. (Answer should be no).
25. Select an officer and firefighter. Take a seat at the driver position. Instruct the officer to build his shape. Tell the firefighter to start the clock for 30 seconds. When the firefighter says "go," tell the firefighter, "Make mine like the officer's." Lesson— Communication is a two-way street. We must talk and listen to all team members. The answers that we seek may be sitting right next to us.
26. Discuss with the class that this exercise was an example of one-way communication (first exercise), limited two-way communication (second exercise) and full two-way communication (third exercise).

# Effective Leader Exercise

**When:** Introduce before delivering the "Teamwork— Leadership" segment.

**Duration:** Five minutes

**Instruction:**

1. Have group list the characteristics, qualities or attributes of an effective leader.
2. When the list is compiled emphasize that most of the items on the list are "people skills" rather than technical skills.
3. Display "Leadership" slide and continue with lecture.

# Effective Follower Exercise

**When:** Introduce before delivering the "Teamwork— Followership" segment.

**Duration:** Five minutes

**Instruction:**

1. Have group list the characteristics, qualities or attributes of an effective follower.
2. When the list is compiled emphasize that most of the items on the list are "people skills" employed by crew members who desire to perform good work.
3. Display "Followership" slide and continue with lecture.
4. Compare how many items from the list match those listed in the "Followership" slide.

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