
Firefighting Risk Management

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"This Guide is a lifesaver for all units on the fire line and in disaster relief support, including State and Federalized Guard organizations. A separate file is a specific risk assessment tool which breaks out a wide range of detailed firefighting tasks. Both can be used in conjunction with the automated Disaster Relief Force Protection Planner."

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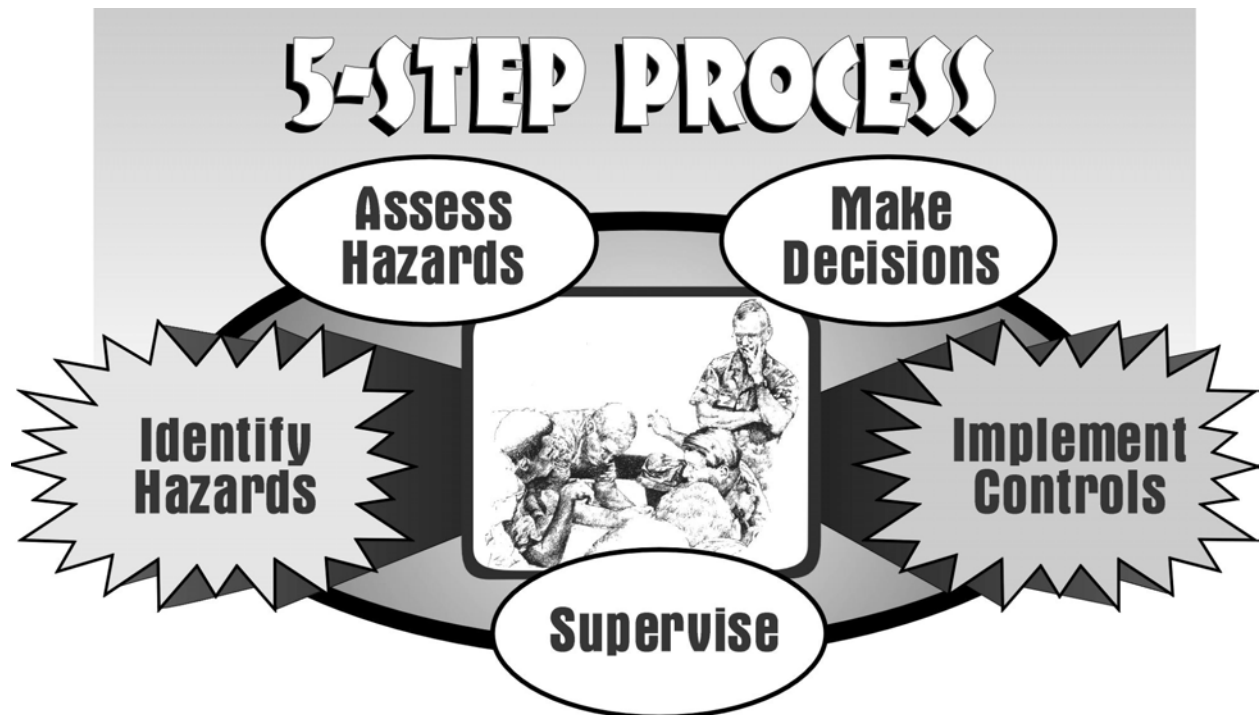
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Section I

Risk Management

Risk management is the process of making operations safer without compromising the mission. It's a tool that allows soldiers to operate successfully in high-risk environments. Leaders at every level have the responsibility to identify hazards, to take measures to reduce or eliminate those hazards, and then to accept risk only to the point that the benefits outweigh the potential costs.

This section provides guidance on integrating risk management into all unit operations. (For more information, see appendix.)



Risk-management terms

Definitions

- **Hazard:** Any real or potential condition that can cause injury, illness, or death of personnel; damage to or loss of equipment or property; or mission degradation.

- **Risk:** Chance of hazard or bad consequences; exposure to chance of injury or loss. Risk level is expressed in terms of hazard probability and severity.
- **Exposure:** The frequency and length of time subjected to a hazard.

- **Probability:** The likelihood that an event will occur.
- **Severity:** The expected consequence of an event in terms of degree of injury, property damage, or other mission-impairing factors (loss of combat power, adverse publicity, etc.) that could occur.
- **Controls:** Actions taken to eliminate hazards or reduce their risks.
- **Risk assessment:** The identification and assessment of hazards (first 2 steps of risk-management process).
- **Residual risk:** The level of risk remaining after controls have been identified and selected for hazards that may result in loss of combat power. Controls are identified and selected until residual risk is at an acceptable level or until it cannot be practically reduced further.
- **Risk decision:** The decision to accept or not accept the risk(s) associated with a mission; made by the commander, leader, or individual responsible for performing that mission.

Risk-management process

Step 1—Identify hazards

- Consider all aspects of METT-T for current and future situations. Sources of information about hazards include reconnaissance, experience of commander and staff, safety SOP, and the unit's accident history.
- Hazards that cannot be adequately controlled by the unit or its subordinate units and that are most likely to result in loss of combat power should be risk-managed. To determine this answer the questions in figure 1.

Step 2—Assess hazards

- Assess each hazard to determine the risk of potential loss based on probability and severity of the hazard. Determining the risk from a hazard is more an art than a science. Use historical data, intuitive analysis, judgment, and the matrix at figure 2 to estimate the risk of each hazard.

Step 3—Develop controls and make risk decision

- Develop control measures that eliminate the hazard or reduce its risk.
- As control measures are developed, re-evaluate risks until all are reduced to a level where benefits outweigh potential cost.
- For each hazard, develop one or more controls that will eliminate or reduce the risk of the hazard. Specify who, what, where, when, and how for each control. When developing controls, consider the reason for the hazard, not just the METT-T factor itself (figure 1). Effective control can be implemented through individual and collective training that ensures performance to standard.
- As controls are developed for each hazard, re-evaluate the residual risk remaining assuming the controls are implemented. Then make the risk decision.

The commander, leader, or individual performing the mission decides whether or not to accept the level of residual risk. When the risk is determined to be too great to continue the mission, he or she develops additional controls or modifies, changes, or rejects the mission.

Step 4—Implement controls

- Put controls in place that eliminate the hazards or reduce their risks.
- Integrate specific controls into plans, orders, SOPs, training performance standards, and rehearsals.

Knowledge of controls down to the individual soldier is essential.

Step 5—Supervise and evaluate.

- Enforce standards and controls.
- Evaluate the effectiveness of controls and adjust and update as necessary.
- Supervise controls by explaining how each control will be monitored to ensure proper implementation.
- Evaluate the effectiveness of each control in reducing or eliminating risk. For controls that are not effective, determine why and what to do the next time the hazard is identified (e.g., change the control, develop a different control, or change how the control will be implemented or supervised).
- Fix systemic problems (figure1) that hinder combat effectiveness.
- Capture and disseminate lessons learned.

		Yes*	No**
Support	Is type, amount, capability, and condition of the following support adequate to control hazard? <ul style="list-style-type: none"> •Personnel •Supplies •Equipment/materiel •Services/facilities 		
Standards	Is guidance or procedure adequately clear, practical, and specific to control hazard?		
Training	Is training adequately thorough and recent to control hazard?		
Leader	Are leaders ready, willing, and able to enforce standards required to control hazard?		
Individual	Is soldier performance and conduct sufficiently self-disciplined to control hazard?		

*No further action required (subject to commander’s risk guidance).

**Risk-manage this hazard.

Figure 1. Need to risk-manage a METT-T hazard

Risk-assessment matrix

The risk-assessment matrix (figure 2) is entered from the probability column and the severity row. Probability and severity levels are estimated based on the user’s knowledge of probability of occurrence and the severity of consequences once the

occurrence happens. The intersection of the probability column and the severity row defines the level of risk.

		HAZARD PROBABILITY			
SEVERITY	Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	Extremely High	Extremely High	High	High	Medium
Critical	Extremely High	High	High	Medium	Low
Marginal	High	Medium	Medium	Low	Low
Negligible	Medium	Low	Low	Low	Low

Figure 2. Risk-assessment matrix for individual hazard

Hazard probability: The likelihood that an event will occur.

- **Frequent:** Occurs often, continuously experienced.
- **Likely:** Occurs several times.
- **Occasional:** Occurs sporadically.
- **Seldom:** Unlikely, but could occur at some time.
- **Unlikely:** Can assume it will not occur.

Severity: The degree of injury, property damage, or other mission-impairing factor.

- **Catastrophic:** Death or permanent total disability, system loss, major property damage.
- **Critical:** Permanent partial disability, temporary total disability in excess of 3 months, major system damage, significant property damage.
- **Marginal:** Minor injury, lost-workday accident, minor system damage, minor property damage.
- **Negligible:** First-aid or minor medical treatment, minor system impairment.

Risk level

- **Extremely high:** Loss of ability to accomplish mission.
- **High:** Significantly degrades mission capabilities in terms of required mission standard.
- **Moderate:** Degrades mission capabilities in terms of required mission standards.
- **Low:** Little or no impact on accomplishment of mission.

Sample Risk-Management Worksheet

Hazards	Initial Risk Level	Controls	Residual Risk Level	How to Implement	How to Supervise	Controls Effective ?

Risk-management integration

Techniques

Two techniques are critical to maintaining unit battle focus:

- **Individual/leader risk management.** This technique focuses on individual through company-level-command thought processes to recognize hazards and take action to reduce risk. Use FM 22-100: *Army Leadership* problem-solving, decision-making, and planning processes. Identify the problem (hazard), gather information, develop courses of action, analyze and compare actions, make a decision, make a plan, and implement the plan. Memory aids such as METT-T and checklists promote consistency.

- **Command-echelon risk management.** This technique uses the FM 101-5: *Staff Organization and Operations Manual* military decision-making process. This process integrates safety and risk assessment into operational decisions normally associated with battalion and higher planning and operations. The commander directs the staff to identify necessary risks and risk controls as “considerations affecting the possible courses of action.” Staff officers use memory aids such as METT-T to promote consistency. The final commander’s estimate and concept addresses significant risk acceptance, eliminations, and controls. Implement these decisions directly into applicable areas of OPLANs (orders). Commanders must

Section II

Ground Operations

This section addresses the areas of concern in ground operations for wildland fire suppression. Listed under each area are the actions to take to reduce the hazards.

Fire Line Safety

General

Situational awareness is extremely important in wildland fire suppression. Soldiers working in the area of a fire must be aware of their surroundings at all times due to sudden wind shifts, erratic fire behavior, extremely hot temperatures and rough terrain.

Personal Protective Equipment

- Ensure that all soldiers have the proper PPE and know how to use it.
- Require all soldiers to carry a Fire Shelter at all times while working the fire line.

Fire Shelters

Inspection and Handling

- Ensure that soldiers inspect their shelters upon initial issue and once a week for pinholes, tears or other damage, especially along the seams.
- Shelters should never be used as seats or pillows.

Deployment: When and Where

- Always deploy a shelter in as large an area as possible and as free of fuels as possible.
- Sites to deploy a shelter include gravel or paved roads, areas cleared by dozers to mineral soil, or black areas with no residual fuel. Good areas are natural firebreaks such as meadows, creek beds, rockslides and depressions in the ground.
- Never deploy a shelter near small trees, grass, brush or firefighting equipment. Also avoid narrow draws, chutes and chimneys and saddles on ridgetops.
- Remind soldiers that they should never deploy a shelter immediately above a large concentration of fuel.
- Remember that flame contact reduces the protection offered by the shelter. It is extremely important to deploy in an area where flames will not contact the shelter.

Communications/Coordination

- Conduct daily briefings on location of safety zones and escape routes.
- Stress the importance of proper radio procedures, especially the acknowledgement of instructions and specific information.
- Ensure that soldiers working near each other at different elevations are in contact with each other by radio and are informed of each other's location.

Situational Awareness

- Ensure that soldiers know the location of nearby troops/fire crews.
- Stress the importance of "Head Up" while working the fireline, don't become too absorbed in the task and lose sight of what is going on around you.
- Be aware of the changing wind conditions and be prepared to change your location.
- Always know where the nearest escape routes and safety zones are located.

Escape

- If entrapment seems likely and time is critical, drop your gear to expedite movement.
- Ensure soldiers know that if a flame front arrives before they are able to fully deploy the shelter the proper action is to get flat on the ground.
- Shrouds should be attached to hardhats for escape because they offer considerable protection against radiant heat.
- Stay alert. Have the shelter unfolded and be ready to grab the shelter edge and get into it.
- Be alert for signs of superheating gases; a rise in air temperature or movement, or blowing embers.

Entrapment: How to Survive

- Hold the shelter down firmly to protect against hot gases.
- Wear your gloves, if they were removed to deploy the shelter, put them back on.
- Wear your hardhat or the foil on the shelter could burn your head.
- Lay flat in the shelter, facedown and never roll up in the shelter.
- Keep your nose pressed against the ground and breathe through a dry bandanna.
- Protect your airways and lungs by staying in your shelter.
- Talk to other soldiers or crews without leaving your shelter.
- Never leave your shelter under any circumstances, it is your only chance of survival.
- Don't move from the shelter until the flame front has passed. The signs are; a drop in noise, wind and heat.

Rest Plan

- Establish rest/break plan in accordance with SOP.
- Provide adequate break periods to compensate for factors such as high altitude, strenuous activity, and hot dry conditions.
- Remind soldiers that drinking water is more important in high altitude, hot and dry conditions.

Hydration

- Ensure that soldiers are drinking water regularly both during firefighting and off-duty hours.
- Advise soldiers to avoid the use of caffeine products as they enhance the loss of body fluids.

Individual Soldier

- Employ the Buddy system to check for heat injuries and fatigue

while working the fire line.

The Forest Service's 18 Watch Out Situations (Hazards) and 10 Standard Fire Orders (Controls).

The 18 Watch Out Situations were developed by the U.S. Forest Service to prevent firefighter injuries and fatalities. Knowing the 18 Watch Out Situations and practicing the 10 Standard Fire Orders will reduce much of the risk of firefighting. These Situations and Fire Orders have been placed within the context of The Army's hazard identification and control measure steps of the Risk Assessment process.

HAZARDS

- 1. In country not seen in daylight.**
- 2. Attempting a frontal assault on fire.**
- 3. Constructing line without safe anchor.**

- 4. Fire not scouted and sized up.**
- 5. Building line downhill with fire below.**

- 6. Unfamiliar with weather and local factors influencing fire behavior.**

- 7. Instructions and assignments not clear.**

- 8. Uninformed on strategy, tactics, and hazards.**

- 9. No communication link between crewmembers and supervisors.**

- 10. Safety zones and escape routes not identified.**

CONTROLS

Fight fire aggressively but provide for **safety first**.

Initiate all action based on current and expected **fire behavior**

Recognize current **weather conditions** and obtain forecasts.

Ensure that **instructions** are given and understood. forecasts.

Obtain current information on **fire status**.

Remain in **communication** With crewmembers, your supervisor, and adjoining forces.

Determine **safety zones** and **escape routes**.

11. Unburned fuel between you and the fire.
12. Terrain or fuels make escape to safety zones difficult.
13. Cannot see main fire, not in contact with anyone who can.

Establish **lookouts** in potentially hazardous situations

14. On a hillside where rolling material can ignite fuel below.

Retain control at all times.

15. Weather gets hotter and drier.
16. Wind increases and/or changes direction.
17. Getting frequent spot fires across line.
18. Feel like taking a nap near fireline.

Stay **alert**, keep **calm**, **think** clearly and **act** decisively.

Bivouac

Sleeping locations

- Establish a designated sleeping area. If situation permits, mark perimeter with engineer tape or chem lights.
- Post unit perimeter security personnel equipped with lights for signaling. Ensure they have been thoroughly briefed on their duties and responsibilities.
- Ensure that vehicles are not parked where they can roll toward sleeping personnel or on an incline without chocks.
- Brief all soldiers on correct driving/sleeping procedures during hours of darkness.

Dismount points

- Establish dismount points beyond which vehicles may not move without ground guides.

Ground guiding

- Require all vehicles to use ground guides, especially during darkness and other periods of reduced visibility.
- Require use of two ground guides when moving tracked vehicles within or through an assembly area at any time.
- Ensure that ground guides use NVGs when appropriate.

- Require that person in vehicle commander's position wear NVGs (if available) during ground-guiding operations at night.

Tents

- Ensure that all personnel fueling/operating tent stoves are properly trained and licensed.
- Ensure that stovepipes extend above the top of tents (spark arrestor is required) and are cleaned periodically.
- Ensure that stoves are not operated at full capacity.
- Ensure ventilation is adequate.
- Ensure operable fire extinguishers are accessible and each entrance and that operators are assigned and knowledgeable.

- Require that electrical circuits be routinely inspected for possible overload condition.
- Ensure that personnel prevent stove fuel from leaking and require immediate cleanup of any spills.
- Establish and enforce smoking areas.
- Use tent liners as added insulation from heat and cold.
- If rebar is used to stake tents, cover the stakes to protect personnel from being cut on the sharp edges.

Overtured plastic water bottles are an excellent cover for the stakes.

Wind

- Ensure sufficient anchorage is provided for tents in sandy and high-wind conditions.

Mess operations

Sanitation

- Ensure all food waste is properly disposed of. If buried, do so daily and at least 30 meters from food preparation areas.
- Ensure food preparation area is at least 100 meters from latrines and 50 meters from incinerators.
- Ensure food is protected from contamination.
- Monitor food handlers and other soldiers to ensure sanitation standards are maintained.

Fire/explosion

- Ensure kitchen fuel storage area is at least 15 meters from working area and is marked as a hazard area.
- Ensure operable fire extinguishers are accessible (with designated operators) in mess-tent area and at stove-lighting and fuel-storage areas.
- Ensure all personnel fueling/operating stoves, immersion heaters, and burners are properly trained.
- Make operators aware that increased heat will add pressure to fuel tanks and fuel cans and that particular attention should be given M2 burners.
- Keep mess-tent exits clear of obstructions.

Cuts/burns

- Remind personnel to—
 - Keep knives sharp, and use the right knife for the job.
 - Not use knives or other sharp implements to open tray packs (use modified can opener and P38).
 - Tilt heated tray packs and cans to right or left when opening to prevent burns from squirting hot juices.

Materiel handling

Load stability

- Remind soldiers that loads can shift in transit and to be particularly careful when opening containers and other shipping containers.

Lift/carry procedures

- Enforce use of correct techniques:
 - Never carry a load heavier than can be managed with ease.
 - When in doubt, get assistance.
 - Bend from the hips and knees, not just the waist.
 - Carry heavy objects close to the body.
 - Avoid sudden movements; move slowly and deliberately.
 - Do not carry unbalanced loads.

Slips, trips, and falls

- Supervise operations.
- Ensure that areas are clear of obstructions and hazards, and remind personnel to use care when vision is obstructed by objects being carried.
- Caution personnel not to jump or step from cargo vehicles while carrying loads; tell them to use a ramp or get help.
- Remind personnel to use extreme care when carrying loads in loose sand or over rough surfaces.

Section III

Aviation Operations

This section addresses areas of concern in aviation operations. Listed under each area are actions to take to reduce the hazards.

Area Operation Survey

- Survey the area of operation and establish hazard maps as the first order of business.
- Coordinate with federal agencies for operation with civilian contract aircraft and airspace use and communications.

Mission Planning

Wire Strike Hazards

- Brief hazards and obstacles for each mission.
- Brief all crewmembers on their responsibility for scanning to detect hazards and obstacles and to inform pilot on the controls.
- Stress the importance of an aerial reconnaissance before each mission to check for new hazards.
- PIC conducts thorough hazard and obstacle briefing before each mission.
- Aircrews conduct thorough and detailed mission planning as a crew.
- Remember that wire strikes are more likely when crew becomes disoriented.
- Mark all known wires on hazard maps.
- Ensure maximum crew coordination in searching for and calling out wires.
- Conduct daily safety briefings which include wire strike prevention tactics.

Performance Planning

- Compute density altitude (DA) before computing weight and balance.
- Always assume density altitude (DA) to be a little higher than calculated.
- Complete the Performance Planning Card and use it.
- Study the density altitude (DA) tables in the operator's manual.
- Always consider the wind direction and velocity for takeoff and landing performance.
- Know your aircraft's weight and balance limitations for varying altitudes.

Crew Selection

- Pair pilots with mountain flying and firefighting experience with inexperienced pilots.
- Select crew based upon Crew Rest policies as set forth in the SOP.

Survival equipment

- Before each mission check for presence and condition of aircraft survival kit and survival vest for each crewmember.

InFlight

Takeoff/Landing

Dry and dusty conditions may result in brownout conditions.

High power demands in confined areas may result in using excessive torque.

- Get aircraft through ETL/single-engine airspeed as quickly as possible.
- Running takeoff is preferred for wheel-type helicopter. Otherwise a maximum performance takeoff is recommended.
- Avoid flying through dust storms, excessive dust and grit will cause damage to internal engine parts, excessive bearing wear, and erosion of rotor blades.
- In dry, dusty conditions a running landing is preferred when terrain permits with minimum ground roll.
- Approach angle should be compatible with available power.
- Be prepared to make a go-around if necessary.
- Always know the wind direction, this is extremely important in high altitude flying.
- Use the recommended techniques for pinnacle operations and confined area operations.
- Divide cockpit responsibilities during all inflight operations to prevent a loss of situational awareness and aircraft control.
- Ensure that crews are familiar with procedures in aircraft operator's manual; chapter 2, FM 1-202: *Environmental Flight*.

Waterbucket Drops

Steep terrain and tall trees present blade strike hazard.

High altitude external load operations may result in using excessive torque.

Steep terrain and tall trees limit capability to maneuver to a safe landing area in the event of a malfunction.

Limited visibility due to smoke and high volume of aircraft in the area may result in a midair collision.

- Conduct aerial reconnaissance of water source before committing yourself on an approach.
- Coordinate with crewmember to call out clearance while lowering bucket into the water source.
- Know your gross weight limitations for the altitude you are working.
- Coordinate duties inside the cockpit; one pilot outside the aircraft looking for other aircraft and monitoring obstacle clearance.
- Be aware of the wind conditions ie; sudden wind shifts and changes in velocity.
- Know your aircraft's limitations as well as your limitations as a pilot.
- Always leave yourself a way out.
- Don't plan on getting rid of your load to avoid flight into terrain, plan ahead.

Weather

Adverse weather may result in the risk of crews entering IMC

Thunderstorm activity/lightning may result in lightning strikes

- Be prepared to abort the mission due to adverse weather.
- Establish EHIRP for area of operation.
- Include EHIRP in mission briefings (unit SOP).
- Spell out crew duties and crew coordination requirements.
- Execute unannounced EHIRP whenever possible.
- Cease operations with the presence of lightning.

Intruder Aircraft

Aircraft not involved with firefighting and operating without talking to anyone may result in a midair collision.

- Ensure the safety of other firefighting aircraft.
- Notify firefighting aircraft in the immediate vicinity of the position of the intruder aircraft.
- Attempt radio contact with intruder aircraft on VHF (known Victor or local Unicom) and assigned FM frequencies.
- Alert local Dispatch of presence and location of intruder aircraft.

Crew rest/fighter management

Individual crew rest plan

- Follow established crew rest plan per SOP.

Sleep quarters

- Reduce environmental noise as much as possible.
- Reduce sunlight in all living areas, including restrooms, during sleep periods.

Maintenance

- Provide crews with sand and dust goggles for wear during runup and shutdown procedures and when clearing aircraft.
- Keep aircraft clean, thus reducing wear and tear caused by a buildup of dust and dirt.
- Use protective covers between flights to protect aircraft from excess heat and to stop blowing dust from getting into moving parts.
- Wipe oil and grease off engine decks and cowling-covered parts.
- Make sure all filters and air cleaners are inspected and cleaned daily.
- Cover radios and receivers with dust covers when possible. Clean ventilating ports and channels to stop overheating.

- Blow dust and dirt out of instrument panels, switches, flight controls, and cables.
- Tape all openings or seams around windows, chin bubbles, and access panels. Do not stop airflow that's needed to cool parts.
- Lubricate main and tail rotors after every flight or at least daily as per appropriate TM.
- Replace damaged sealant around windows, doors, and chin bubbles.
- Remove oil cooler compartment access panel daily, and clean caked dirt off fan's inner lip.
- Keep windows clean and covered when aircraft are parked.
- Don't let covers touch windshield. Protect windows with Styrofoam, newspaper, cardboard, or other nonabrasive material—then attach cover.
- Add oil and hydraulic fluid directly from original unopened containers to help stop dust and dirt from getting into helicopter's lubrication and hydraulic systems. Dispose of partially used containers.
- Wipe off excess grease every time lubricant is applied. Grease attracts dust and dirt, forming a paste that grinds and wears lubricated parts.

Forward arming and refueling points (FARPs)

- When planning a FARP location, consider the prevailing winds. Plan for aircraft to land directly to a refueling point instead of a spot short of it that would require aircraft to hover, inducing blowing dust.
- Establish holding areas away from the FARP for aircraft awaiting refuel/rearm space.
- Ensure that shutoff valves are marked and that all personnel using or running equipment know how to shut it off.
- Mark refueling points, areas around aircraft tail rotors in combined refueling and rearming points, and passenger-holding areas.
- Require daily inspection of grounding systems.
- Ensure fuel and ammunition handlers are familiar with FM 10-67-1 and FM 1-104 procedures. • Use extreme care when handling engine fuel at temperatures above 120°F to prevent possible sparks and explosion. Open gasoline drums with bronze or other nonsparking tools.
- Look for and correct improper grounding points, deteriorated or leaking hoses, leaking nozzles, incorrect sampling procedures, improper storing or dumping of waste POL products, lack of personal-protective equipment for refueling personnel, no water at refueling site, unserviceable fire extinguishers, and no controlled access into and out of refuel points.
- Keep gasoline drums covered and, where possible, maintain storage temperatures below 120°F.
- Remember that fuel expands in very hot temperatures.
- Cease fueling operations if lightning is observed.
- Ensure that fuel does not become contaminated by dirty nozzles and other unclean equipment.
- Consider positive control of air traffic and ground traffic around refueling sites to reduce potential of midair/ground collisions.
- Keep camouflage materials (netting/foilage) as far from rotor-blade systems as possible to prevent FOD.
- Be aware of fire-hazard possibility from static electricity. Connecting the nozzle bonding wire before opening the fuel cap will prevent a static arc from occurring in the presence of fuel vapor and significantly reduce the fire hazard.

**Warning: High-frequency radios will not be operated within
100 feet of aircraft being armed and/or refueled.**

Caution: The region is known as a
static electricity hazard area.

Section IV

Human Factors

Firefighting is a very strenuous activity which takes place in a very hostile environment. But there are ways you as a leader can reduce the hazards. This section discusses some of them.

Supervision

Statistics show that 80 percent of all accidents are caused by human error, and supervision is the key to preventing human error. Simply put, leaders can reduce human error by establishing sound standards and consistently enforcing them.

Failure to enforce a standard serves to establish a new, lower standard that may one day result in an accident. If, for example, you sit in the passenger seat and allow a driver to operate a vehicle too fast for conditions, you have failed to supervise, and you have failed in your leadership responsibility. You might make *that* trip; however, you've set the stage for a future accident.

Consistent enforcement demonstrates "tough caring," which is looking out for the welfare of soldiers.

Buddy system

Establish a buddy system and provide guidance on the issues buddies should help each other with. Examples include enforcement of water consumption; eating; personal hygiene; watching for sunburn, fatigue, sickness, heat injury, and cold injury; and swimming. Don't forget that leaders also need a buddy, because leaders frequently try to tough-out injuries to remain in the action.

High Altitude

Acclimatization

Adjust activity level during the first two days to allow soldiers to adjust to the high altitude. Encourage soldiers to avoid the use of alcohol and sleeping medications for three to four days before arrival at firefighting site.

Syncope

- Occurs within the first 24 - 48 hours.
- May take place following a meal, after standing up or with exertion.

Acute Mountain Sickness

The most common form of altitude illness is a constellation of symptoms known as Acute Mountain Sickness (AMS).

Symptoms: headache, nausea or vomiting, sleep disturbance, dizziness, shortness of breath, anorexia, and fatigue. Nausea may be severe enough to impair adequate fluid intake. Vomiting indicates more severe illness and also can lead to significant dehydration.

- Use the Buddy system to identify soldiers suffering from High Altitude Sickness.
- Be aware symptoms are most likely to appear during the first two days on location.
- Alert your Fire Team Crew Leader or Medic at the first appearance of symptoms.
- Plan level of activity during the first two days to allow soldiers to acclimatize to high altitude operations.

Hot weather

Acclimatization

As a rule of thumb, 2 weeks are required to adjust to the region’s humidity and extreme heat. The following chart is a reasonable guideline for minimal acclimatization.

Total Hours of Work *		
Day	Less than 80° WBGT	More than 80° WBGT
1	2 hours	2 hours
2	3 hours	3 hours
3	4 hours	4 hours
4	6 hours	5 hours
5	Regular duty	6 hours
6		Regular duty

*Hours should be evenly divided between morning and afternoon.

If time for acclimatization cannot be provided for your soldiers, supervision and the buddy system become even more important.

Sunburn

In extreme heat, the body is cooled by sweat. Since sunburn inhibits sweating, every precaution must be taken to prevent sunburn. Common sense dictates maximum use of shade, sunscreen, and/or clothing that covers as much exposed skin as possible. In addition, remind soldiers to use the buddy system to watch for signs of sunburn.

Water consumption/salt loss

When the body loses water, it also loses salt. Salt should be replaced by normal consumption of food. **Do not use salt tablets.**

An individual may lose more than a quart of water per hour through sweating. Water loss must be replaced by frequent intake of small amounts of water. Water should be sipped, not gulped. Do not conserve water. Soldiers *must* drink even when they are not thirsty! **Thirst is not an adequate indicator of dehydration.**

The following chart represents a modification of previous fluid-replacement guidelines. While still undergoing validation, it represents the best guidance currently available from the U.S. Army Research Institute for Environmental Medicine and the U.S. Army Center for Health Promotion and Preventive Medicine.

Fluid Replacement Guidelines for Warm-Weather Training (Average Acclimated Soldier Wearing Hot-Weather BDU)

Easy Work	Moderate Work	Hard Work
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Heat Category	WBGT °F	Work/Rest*	Water Per Hour	Work/Rest*	Water Per Hour	Work/Rest*	Water Per Hour
1	78-81.9	No limit	½ qt	No limit	¾ qt	40/20 min	1 qt
2	82-84.9	No limit	¾ qt	No limit	1 qt	30/30 min	1 qt
3	85-87.9	No limit	1 qt	40/20 min	1 qt	30/30 min	1 ¼ qt
4	88-89.9	No limit	1 qt	30/30 min	1 ¼ qt	20/40 min	1 ¼ qt
5	>90	No limit	1 ¼ qt	30/30 min	1 ¼ qt	15/45 min	1 ¼ qt

*Rest means minimal physical activity (sitting or standing) and should be accomplished in the shade if possible.

Note 1: MOPP gear or body armor adds 10°F to WBGT Index.

Note 2: Hourly fluid intake should not exceed 1½ quarts. Daily fluid intake should not exceed 10 quarts.

Easy Work	Moderate Work	Hard Work
<ul style="list-style-type: none"> • Weapon maintenance • Walking hard surface at 2.5 mph, <30-pound load • Manual of Arms • Marksmanship training • Drill and ceremony 	<ul style="list-style-type: none"> • Walking loose sand at 2.5 mph, no load • Walking hard surface at 3.5 mph, <40-pound load • Calisthenics • Patrolling • Individual movement technique; i.e., low crawl, high crawl. 	<ul style="list-style-type: none"> • Walking hard surface at 3.5 mph, >40-pound load • Walking loose sand at 2.5 mph with load

Following these requirements will not necessarily prevent dehydration. Dark urine is an indicator of dehydration.

Alcohol and soft drinks are not substitutes for water. Alcohol exacerbates dehydration, and soft drinks are not absorbed as rapidly as water into body tissue. Soft drinks containing salts (e.g., *Gatorade*) may increase individuals' water requirements.

Soldiers who are overweight, dieting, or past heat casualties are more prone to heat injuries. As a result, their activities must be closely monitored:

- Enforce hydration and monitor water use.
- Provide cool water when possible.
- Enforce work/rest cycles.
- Watch for signs of heat injury (see below).
- Know individual physical conditions and assign appropriate work.
- Establish and ensure use of the buddy system.

Signs, symptoms, and first-aid

When prevention fails, it is critical that everyone be able to recognize and treat heat injuries. Following is a discussion of the most common injuries.

Heat cramps are caused primarily by excessive loss of salt from the body.

Symptoms: Muscle cramps of the abdomen, legs, or arms.

First-aid: Move the victim to shade and loosen clothing. Dissolve ¼-teaspoon table salt in one quart of water, and have the victim slowly drink at least one quart of the salt solution. Seek medical treatment.

Heat exhaustion is caused by excessive salt depletion and dehydration.

Symptoms: Profuse sweating, headache, tingling sensation in the extremities, weakness, loss of appetite, dizziness, nausea, cramps, chills, and rapid breathing.

First-aid: Move the victim to shade and loosen or remove clothing. Elevate legs, and pour water on the victim. Have the victim drink water, and fan him or her. Seek medical treatment.

Heat stroke is a medical emergency; immediate action is required.

Symptoms: Generally patterned after heat exhaustion; however, skin will be hot and dry. Victim may suddenly lose consciousness and have seizures.

First-aid: **Seek immediate medical attention.** Move the victim to shade and immerse in water if possible (cool water is even better) or douse with water. Fan and elevate feet. Ensure cooling process is continued during transport to medical facility.

Fatigue

Fatigue causes accidents. After 48 to 72 hours without sleep, soldiers become militarily ineffective. So, the best measure against fatigue is sleep. Water consumption, diet, physical conditioning, personal hygiene, and meaningful work all impact on fatigue. Ensure the impact is positive. (For more information, see *Leader's Guide to Crew Endurance*, which is available at the Army Safety Web Site, <http://safety.army.mil>.)

Risk management and crew endurance

See appendix.

Symptoms of fatigue

Watch for the following symptoms of fatigue:

- Headaches.
- Poor physical hygiene.
- Impatience/irritability.
- Loss of appetite.
- Inability to focus on task at hand.
- Outright physical exhaustion.
- Inability to make decisions.

These symptoms manifest themselves in—

- Increased errors.
- Difficulty in following instructions.

- Lack of motivation.
- Carelessness.

All this may translate into unnecessary risk-taking or shortcuts to get the job done—an open invitation for an accident.

Facts about sleep deprivation

- You cannot train to overcome sleep loss.
- Tasks—even *critical* tasks—that are uninteresting and take a long time are extremely conducive to sleep.
- Performance of mental tasks requiring calculations, creativity, and ability to plan ahead declines by 25 percent for every 24-hour period of semi-continuous work without sleep.
- The abilities of leaders are degraded by sleep loss, impacting on quick and effective responses to changing battlefield conditions.
- Tasks that have been well-learned and repeatedly practiced are more resistant to sleep-loss effects.

Therefore, select the best trained to perform critical tasks.

- The ability to learn *new* information is compromised by sleep loss.
- Leadership ability cannot overcome sleep loss.
- Sleep loss over time (greater than 2 days) has a cumulative effect.

Guidelines for sleep plans

- 6-8 hours' sleep daily will maintain mental task performance indefinitely.
- 3-4 hours' sleep daily will maintain mental task performance for 5 to 6 days.
- Less than 4 hours' sleep daily over a 3- to 6-day period will impair military effectiveness.
- Best sleep periods, given limited choice, are 0300 to 0600 and 1600 to 1900.
- Provide for a *minimum* of 4 to 5 hours' quality (uninterrupted) sleep; however, after 6 to 7 days, accumulated sleep loss will equate to performance of 48 hours without sleep.
- After 25 to 36 hours without sleep, decisions and calculations should be cross-checked by a second person. Use a mix of rested and unrested soldiers as check and balance.
- Allow for naps as often as possible. Four 1-hour naps in a 24-hour period are as beneficial as 4 hours' sleep. However, accumulative sleep loss is more severe with fragmented sleep.
- Sleep plans should include provisions to recover from sleep loss:
 - 12 hours of sleep/rest (at least 8 to 10 hours' sleep) are required after 36 to 48 hours' acute sleep loss.
 - 24 hours of sleep/rest (at least 15 hours' sleep) are required after 36 to 48 hours' sleep loss under conditions of high workload (12 to 16 hours per day). This is particularly important for commanders/staff with high mental task workloads.
 - 2 to 3 days of sleep/rest are required after 72 to 96 hours' sleep loss. The sleep/rest period means 8 to 10 hours of sleep per day and light duty.

Personal injuries

Eyes

Precautions should be taken to protect the eyes by wearing protective lenses, goggles, or face shields/face shrouds when the job calls for it. Heavy smoke and high heat conditions may cause eye injuries. Blowing dust also causes major problems for contact-lens wearers.

Ears

Leaders must enforce the use of hearing protection when working near or operating heavy equipment, when on board Army aircraft, and when operating Army combat vehicles.

Head

Helmets must be worn at all times by all personnel riding in or operating Army combat vehicles. Helmets or hard-hats must also be worn in construction areas in accordance with SOP and local and Army regulations. Helmets must be worn at all times while working the fireline.

Hands

Rings are a common source of personal injury. Soldiers frequently catch rings on the tailgate of vehicles while dismounting, causing severe hand injuries.

Back

In most cases, back injuries occur when individuals overextend themselves. Leaders must remind soldiers to get help when lifting heavy objects and to lift with their legs, not their backs.

Feet

Leaders must enforce the wear of protective boots in areas that require toe protection (e.g., maintenance, engineer, warehousing, and materiel-handling areas).

Health and hygiene

Water

- Remind soldiers to ensure that water is treated; serious diseases can be transmitted by untreated water.
- Warn soldiers not to use ice in drinks unless the water used was treated. Remind them to consider ice to be contaminated unless they *know* it has been treated. Emphasize that untreated ice can be used only for chilling containers.

- *Schistosomiasis* is a common parasite in bodies of water. Warn soldiers not to go into water unless it is necessary or an area approved by the chain of command.
- Maintain the chlorine level of water stored in trailers at 5 ppm.

Water purification

- Water purification requires use of hazardous chemicals. Ensure that soldiers wear eye protection and rubber gloves when handling these chemicals.
- Water purification operations create waste water. Ensure that waste water and waste chemicals are isolated from operational areas and disposed of in approved dump sites.
- Ensure that the Reverse Osmosis Water Purification Unit (ROWPU) power source is properly grounded.

Laundry and bath

- Laundry operations require equipment to be operated at specific temperatures; to prevent fires, ensure that temperatures listed in the appropriate operators manual are not exceeded.
- Ensure that laundry units operated inside tents have adequate ventilation.
- Ensure that high-voltage laundry units are grounded and that circuits are not bypassed.
- Ensure that operators are using fuels prescribed in the appropriate operators manual to prevent overheating and fire hazards.

Food

- Keep perishable foods below 45°F or above 140°F prior to serving.
- Dispose of perishable foods held in insulated containers more than 4 hours.

Critters

Snakes and insects

Bottom line—tell your soldiers to leave snakes alone. There are poisonous snakes in the region (e.g., Rattlers: Diamondback and Massasauga). Even bites from nonpoisonous snakes can be harmful; if not properly cared for, nonpoisonous snakebites can become infected. Anyone bitten by *any* snake should seek medical help immediately for evaluation for anti-venom treatment. Tell soldiers *not* to treat snakebites with the cut/suck method.

Warn soldiers that snakes burrow under rocky outcroppings seeking shade during the day and heat at night. Remind soldiers to avoid sudden motion when placing their hands or feet near an area that could conceal a snake. They should be especially careful when climbing or when lifting objects from the ground.



Black widow spiders, desert recluse spiders, and mosquitoes can cause illness and infected wounds. Remind soldiers to shake out their clothing before dressing and to check boots before putting them on. Where possible, boots should be placed off the ground or inside a waterproof bag or other container. Soldiers should also carefully check their bedding before use. Also remind them that food crumbs attract insects, which in turn attract spiders and other insects.

Direct soldiers to use insect repellents religiously and to use only those approved for human use. Deet repellent lotion is recommended (NSN 6840-01-284-3982). Also available is Permethrin clothing repellent (NSN 6840-01-278-1336). Caution soldiers to carefully follow instructions for use of these products. Also warn them to remain still if they feel an insect or spider crawling on their body. Sudden movement could cause a bite or sting.

Animals

Animals may be carriers of rabies. Warn soldiers not to taunt or play with animals.

Respiratory

Mucous membranes

Nostrils are subject to dry out from the smoky environment. Tell your soldiers to wear their PPE to reduce smoke inhalation. Also tell them to cup water in their hands and “snuff” several times daily.

Hydrogen sulfide

Hydrogen sulfide is a gas emitted from petroleum-based products. It has the characteristic “rotten egg” odor. It is a systemic poison that can be fatal.

- Expect to encounter the gas around oil-well heads, drilling platforms, oil-storage tanks, and pumping stations. Locally produced diesel fuel contains hydrogen sulfide.
- The gas is heavier than air; therefore, it will concentrate in low areas (depressions) and confined areas such as cargo areas of ships.
- Handle diesel fuels in well-ventilated areas.
- Warn soldiers to notify their chain of command immediately if they smell the “rotten egg” odor. Medical personnel should check the toxic level to determine if it is lethal.

Caution: The odor may go away. However, that does not mean the gas is not still present. Hydrogen sulfide gas will cause olfactory fatigue (i.e., the brain ceases to recognize the smell).

Burning brush

Caution soldiers that inhalation of smoke may cause respiratory problems, including sickness and, in extreme cases, death.

Lost

Terrain features are either absent or constantly changing. Counsel soldiers to follow the example of local residents and create “features” using stacks of rocks or pieces of cloth attached to poles to identify the route taken.

- Instruct soldiers to inform their Fire Team Crew Leader anytime they leave the fireline.
- Use the buddy system. Two individuals missing will be noticed sooner than one, and two are less likely to become lost.
- Instruct soldiers to remain in place when lost.
- Review field-expedient methods of determining direction.
- Review field-expedient methods of map orientation.

- Counsel soldiers to use dead-reckoning to navigate.

Section V

Accident Reporting

The “minor” accident in your unit may seem unimportant; however, added to others Armywide, it may help to identify a trend. Trend identification is essential to analyzing accidents in order to develop programs to protect soldiers and equipment.

The Army Safety Center needs to know about accidents that happen in your unit; your accident reporting to your chain of command is crucial to our ability to help soldiers operate safely. Report all accidents as per chapter 3, AR 385-40: *Accident Reporting and Records*, dated 1 November 1994.

The commander who first becomes aware of any Class A or B Army aviation or ground accident, or Class C Army aviation accident (flight, flight-related, or aircraft-ground) will, through the existing chain of command, immediately notify the immediate commander of personnel involved and the U.S. Army Safety Center (DSN 558-2660/3410, commercial 334-255-2660/3410).

Peacetime

Ground-accident reports will provide, at a minimum, the information required for DA Form 7305-R: *Worksheet for Telephonic Notification of Ground Accidents*. Aviation-accident reports require the information on DA Form 7306-R: *Worksheet for Notification of Aviation Accidents*. These reproducible forms are in the back of AR 385-40.

Ground Class C and D accidents will be reported using the DA Form 285-AB-R: *Abbreviated Ground Accident Report (AGAR)* within 30 calendar days of accident occurrence.

Aviation Class D accidents and Class E and F (engine foreign-object-damage (FOD)) incidents will be reported using DA Form 2397-AB-R: *Abbreviated Aviation Accident Report (AAAR)* within 10 calendar days of accident occurrence. No follow-up is required unless new information is discovered that—

- Relates to either safety of use or safety of flight.
- Changes the accident classification.
- Significantly changes the information already submitted.

Combat

Initial notification requirements for reporting accidents during combat operations remain the same as for peacetime. However, when the senior tactical commander determines that the situation, conditions, and/or time does not permit normal peacetime investigation and reporting, the following reporting criteria can apply.

Aviation Class A and B accidents can be reported by use of the AAAR, and Ground A through D accidents can be reported through use of the AGAR (table E-1, AR 385-40).

Accident classification

Detailed guidance regarding accident classification is provided in chapter 2-2, AR 385-40. A quick synopsis is as follows:

- **Class A:** More than \$1,000,000 damage, specified equipment destroyed, a fatality, or a permanent total disability.
- **Class B:** \$200,000 to \$999,999 damage, a permanent partial disability, or five or more personnel hospitalized for the same incident.
- **Class C:** \$10,000 to \$199,000 damage or a nonfatal injury or illness causing loss of time from work.
- **Class D:** \$2,000 to \$9,999 damage.
- **Class E:** Less than \$2,000 damage.
- **Class F (engine FOD):** Recordable damage to aircraft turbine engine (does not include auxiliary power units (APUs)).

TASK	HAZARD/RISK IDENTIFICATION	RISK ASSESSMENT	CONTR COUN
BUILDING A FIRELINE	<p>-Soldiers in close proximity to flames resulting in burns or death</p> <p>-Soldiers are entrapped resulting in death or serious injury</p>		<p>-NIFC will issue each training on it's use.</p> <p>-Commanders will em</p> <p>-Commanders/FireTea location of safety zon</p> <p>-Commanders and Fir emphasize the use of</p> <p>-Soldiers will receive and fireline safety fro</p> <p>-Air and Ground Med</p> <p>-Units will have a NIF with them at all times</p> <p>-Risk Assessment will will be ongoing.</p> <p>-Soldiers will receive</p> <p>-Commanders will em channels so that infor firecrew team leader t such as:</p> <ul style="list-style-type: none"> *weather condition *location of nearb *passing of inform *location of nearb working at differ <p>-Soldiers will receive use a Fire Shelter.</p> <p>-NIFC will issue each training on it's use.</p> <p>-Commanders/Fire Te emphasize the proper</p> <p>-Air and Ground Med</p> <p>-Units will have a NIF them at all times.</p>

TASK	HAZARD/RISK IDENTIFICATION	RISK ASSESSMENT	CONTR COUN
BUILDING A FIRELINE (CONT'D)	-Falling snags, branches may result in head injuries or death: occurrence is higher during night or low-light conditions		<ul style="list-style-type: none"> -NIFC will issue each training on it's use. -Commanders will em -Commanders will stro maintaining situationa -

TASK	HAZARD/RISK IDENTIFICATION	RISK ASSESSMENT	CONTR COUNT
		HIGH	

TASK	HAZARD/RISK IDENTIFICATION	RISK ASSESSMENT	CONTR COUNT

TASK	HAZARD/RISK IDENTIFICATION	RISK ASSESSMENT	CONTR COUNT
CONDUCT GROUND OPERATIONS.		HIGH	

RESIDUAL RISK
HIGH

TASK	HAZARD/RISK IDENTIFICATION	RISK ASSESSMENT	CONTR COUN

TASK	HAZARD/RISK IDENTIFICATION	RISK ASSESSMENT	CONTR COUN
CONDUCT AVIATION OPERATIONS (CONTINUED)			

TASK	HAZARD/RISK IDENTIFICATION	RISK ASSESSMENT	CONTR COUN
Building a Fire Line (Cont'd)	<p>Falling Snags: Fire-weakened timber resulting in injuries</p> <p>Rolling rocks: Causing injuries and burns</p> <p>Dehydration: Heat injuries</p> <p>Fatigue: Physical Exhaustion, injuries and could lead to entrapment and loss of situational awareness</p>		<p>-Leaders will stress the good situational awareness at all times.</p> <p>-Leaders will enforce the US Forest Service's 10-2 rule.</p> <p>-Air Medevac and Ground location.</p> <p>-Leaders will stress the situational awareness and look down and look around.</p> <p>-Leaders will enforce the US Forest Service's 10-2 rule.</p> <p>-Leaders will ensure the nearby escape routes.</p> <p>- Air Medevac and Ground location.</p> <p>-Commanders will ensure after duty hours.</p> <p>-Leaders will emphasize caffeine products.</p> <p>-Leaders will enforce the US Forest Service's 10-2 rule.</p> <p>-Leaders will ensure the US Forest Service's 10-2 rule.</p> <p>-Leaders must recognize pushed beyond their limits.</p>