High Tech versus Low Tech Training

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Abstract: The United States Marine Corps has some of the most advanced weapons systems and training in the world, yet they make extensive use of "low tech" training tools. Sand table exercises and tactical decision games are used by Marines all over the world, at sea and on land. Although the U.S. Department of Defense has a nearly $18 billion annual training budget, the Marines choose to teach decision making and tactics to entry level officers through the use of low tech methodologies. There may be a lesson here for wildland fire agencies with far smaller training budgets wishing to teach similar skills.

In recent years, the wildland fire community in the U.S. has seen an increase in use of technological resources from advanced fire behaviour prediction models to fire simulations. This trend towards increased reliance on emerging technologies combined with perceived discarding of traditional training, leadership, and decision making assessments has created concern for many in wildland fire management. Large amounts of money are being spent searching for the newest technological widget. Yet a phrase coined in the business community may ring true for us as well: "better, faster, cheaper: you can have any two out of the three, but not all three at the same time. You choose".

Hundreds of thousands of dollars have been spent developing computer-based wildland fire simulations. These applications promise to add exciting new dimensions to wildland fire training. However, there are disadvantages associated with this type of training tool. First, it requires several computers with high-end video cards installed. Second, it requires someone with Information Technology skills to run it. Third, it requires some level of effort to integrate this technology into existing training courses. Fourth, software development is very expensive.

Sand table exercises, on the other hand, require only an 8' x 4' box of sand with some toy figures of people and fire engines, material that looks like vegetation and smoke (e.g., cotton), and chalk to mark fire perimeters and roads. Sand tables can be used in remote locations. The only limitation to sand table exercises is the trainer's imagination; an infinite number of scenarios can be created to stimulate learning. Individuals can be placed in situations where they have to make decisions and communicate them to subordinates. Investigation reports for tragedy fires have often pointed to indecisiveness and poor communication as causal factors in accidents.

Low tech training versus high tech training – how to decide? How much money is available to a training department? What level of "fidelity" is needed: does training have to be absolutely "realistic" or does it just have to produce the desired learning outcome? How much technology is needed to provoke firefighters into making decisions in a training environment where no firefighters are at risk? Do young people from today's video game generation expect high tech computer-based training?

The selection of training tools should be a process similar to that of selecting tools with which to fight a fire: choose the right tool for the job.

Educational and Simulation Theory behind the use of simulations to train firefighters

Perhaps one of the most visible developments in the training field in the last ten to fifteen years has been the widespread use of simulations. Simulations are now used to teach people everything from medical procedures to air traffic control. Perhaps no other training method better illustrates the differences between high-tech and low-tech approaches to training.

When designing any type of training, it is worthwhile to consider precisely how people learn. Three distinct learning theories are worthy of consideration: sensory stimulation theory, reinforcement or behaviour modification theory, and brain-based learning theory. Sensory stimulation theory simply says that learning happens when instruction stimulates the senses of the learner. Reinforcement theory, largely based on the work of behavioural psychologist B. F. Skinner, states that the active involvement of the learner is inherent in successful reinforcing learning experiences (Margolis et al. 1989). Skinner wrote that "to acquire behaviour, the student must engage in behaviour." Brain-based learning proponents maintain that education must involve "designing and orchestrating lifelike, enriching, and appropriate experiences for learners" as well as "ensuring that students process experience in such a way as to increase the extraction of meaning." (Caine et al. 1991). Simulations fit all of these learning theories: they provide stimuli, engage students in behaviour, and orchestrate lifelike experiences for our learners.

The use of After Action Reviews in conjunction with simulations can help ensure that wildland firefighters extract meaning from their experiences during training. This knowledge can be very useful later on in real-life situations. We acquire knowledge – we learn – by processing experience (Caine et al. 1991). Simulations are a type of experience. For wildland firefighters, the singular advantage that simulations have over real-life experience is that in a simulation, no one gets hurt. Students can learn from failure in a risk-free environment. Another advantage is that simulations are repeatable, unlike many experiences in real life. If you don't get it right the first time, you get another chance.

In his book "Virtual Learning", researcher and academician Roger Schank writes: "most organizations invest the bulk of their training dollars in lecture-and-memorize methods, as if listening to lectures and reading manuals suddenly caused all the information presented to be magically engraved in one's mind, turning novices into experts overnight." He goes on to say that people learn better when learning is fun, and that what is fun is doing. "Computer simulations or non-computerized role-playing offers people the chance to participate, to make mistakes, to take chances, to challenge themselves, and to learn" (Schank 1997).

There are many different types of simulations: social-system simulations, data management simulations, diagnostic simulations and so on. For the purposes of wildland firefighting, the simulations currently in use can be broadly categorized as crisis-management simulations. Certain characteristics of a situation denote a crisis. Crises typically threaten the goals of a decision-making unit, restrict the time available for reaction before the situation changes, and surprise the members of the decision making unit when they occur. In crises, information available to decision makers is often distorted or incomplete. Like crises, crisis-management simulations share certain characteristics. First, the situation in a simulation scenario must be perceived as a threat. Second, time available for data -gathering and solution-testing must be severely limited. Third, effective crisis-management simulations need to produce the same reactions and feelings in participants as real-life crises do (Gredler 1994).

Decision theory behind the use of simulations to train firefighters

Having established that simulations can provide valuable and effective learning experiences for adult learners, a number of other questions arise. For example, what should be taught to wildland firefighters, using simulations? Do certain subjects lend themselves to this method of instruction more than others? Are certain types of simulations better suited to some subjects than others?

An important distinction to make at this point is the difference between "simulation" and "simulator". A simulator is defined as "a device that enables the operator to reproduce or represent under test conditions phenomena likely to occur in actual performance." For example, many people are familiar with the flight simulators used by commercial pilots to learn how to fly large jets. "Simulation" is defined as the "imitative representation of the functioning of one system or process by means of the functioning of another" (Merriam-Webster 1998). The example here would be a computerized terrain model on which a fire propagates: the computer is imitating the functioning of the natural environment.

In general, complex subjects that involve the interaction of people with other people, terrain, weather and fire are suited to training through simulation. Task-oriented procedures may not be as well suited to the use of simulation. For example, the best way to teach a firefighter to start a portable pump might be to actually have him or her start and operate the real pump, not a simulated version of the pump. On the other hand, with a simulation a firefighter can be taught to improve communication skills needed during a chaotic initial attack fire in the urban interface.

Wildland firefighters can learn many things from simulation-based training, including fire behaviour, tactics, communications and decision making. The wildland fire simulations currently in use in the United States, however, all share the same basic objective: to bring wildland firefighters, working individually or as a team, to one or more decision points in the context of a realistic scenario. Elements of risk, uncertainty and time pressure are introduced to get the learners to practice functioning under realistic conditions. As the firefighter or team makes decisions in the simulation, the decisions must be clearly communicated to peers, subordinates or superiors. Afterward, the scenario, the decisions and the reasoning behind the decisions can be analysed for the benefit of all participants. For obvious reasons, trainees in such a decision making exercise are often referred to as being "in the hot seat".

Military organizations and academic institutions have long studied how people make decisions. From this study, two basic decision making models have emerged. The first is called the classical, or analytical decision making model. The second is called the naturalistic or "recognition primed" decision making model. The analytical model of decision making holds that decision making is a rational and systematic process of analysis based on the concurrent comparison of multiple options (Schmitt 1996). In this model, all possible options are identified, analysed according to the same set of criteria, and ranked. Analytical decision making works best when accurate information is available and there is enough time to conduct a thorough analysis. For example, the decision making process involved in buying a car would typically be considered analytical: evaluating a number of models based on passenger needs, safety, cost, availability, etc., before deciding what to buy.

Recognition primed decision making, on the other hand, emphasizes the use of pattern recognition rather than calculation or analysis for rapid decision making. A major finding of a study titled "Rapid Decision Making on the Fire Ground", conducted by the U.S. Army Research Institute for the Behavioral and Social Sciences in 1988, was that experienced fire ground commanders rarely reported having considered more than one option when making a decision. For these fire ground commanders, their ability to handle decision points appeared to depend not on systematic analysis, but rather on their skill at recognizing situations as typical, as instances of general prototypes that they had developed through experience (Klein et al. 1988). This pattern-recognition or prototyping skill enabled these experienced fire ground commanders to identify good options immediately. In most cases, the fire ground does not allow enough time for the lengthy analyses and option comparisons required by analytical decision making.

In a wildland fire simulation or on a wildfire, recognition primed decision making will be the type of decision making used in most instances. In some cases, trainees will not already possess enough mental "prototypes" generated by their real life experiences to make good decisions in a simulation. In these cases, the simulation itself represents a kind of prototype experience that can be used later when the trainee is in a real world decision making situation. Problems with leaders making sound, timely decisions and communicating them effectively to others are identified repeatedly in investigation reports on fatality fires. Training that focuses on the improvement of these decision making and communication skills should have a positive impact on firefighter safety over the long term.

Wildland Fire Simulations currently in use in the United States

The four types of wildland fire simulations described in this paper can be broadly categorized as follows: computer-based, video-based, scripted role-playing, and sand-based. On the "high-tech" end of the spectrum are the computer and video simulations. On the "low-tech" end are the scripted role-playing and sand-based simulations. All four types of simulations require the active involvement of humans to run the simulations and make adjustments as trainees interact with simulation scenarios, make decisions and alter the course of the simulation. A more detailed description of each of these simulations follows.

Computer-based simulation. Officially known as the 3-D Virtual Wildland Fire Simulator, this product was developed by the U.S. Forest Service in conjunction with a private vendor, Dynamic Animation Systems, Inc. (DAS). Dynamic Animation Systems is also the developer of a structural firefighting 3-D simulator for the National Fire Academy in Emmitsburg, Maryland.

The National Fire Academy uses their system in some of their command/staff training; they have built a "simulation lab" on their Emmitsburg, Maryland campus, installing computer hardware and software that allows them to network four classrooms together with a control room from which simulations can be directed. The result is a high fidelity, three-dimensional virtual environment through which students can "move" and view fires from different perspectives. In other words, students in Classroom A might be looking at the front of a building, while students in Classroom B might be seeing the back of the same building.

Development of the 3-D Virtual Wildland Fire Simulator began after the National Fire Academy's system was nearly complete. The Wildland Fire software provides a physically realistic fire propagation model based on fuel types, various environmental conditions, and topography. Although much of the software from the previously developed structural fire simulation system could be used in the wildland fire system, there were also many new features to be developed. For example, different types of vegetation and terrain, giving trainees the ability to request wildland fire suppression resources, and the ability for simulators to change wind direction and speed were all required. Trainers strongly desired the ability to use actual terrain in wildland fire simulations, and they needed the flexibility to be able to add structures, to more accurately depict some of our wildland/urban interface situations. A scenario editor feature was added to the program this year, giving instructors the ability to create a nearly unlimited number of training scenarios in addition to using the "canned scenarios" built into the program (Studebaker 2003).

Students do not sit in front of a computer and enter keyboard commands to make this system react. Typically, students are in a room with a large monitor that shows the fire spreading in "real time". Students can order and place resources on the fire; at the instructor's console, the trainer can decide when resources arrive and define the fireline being constructed. Eventually, students will see the results of their resource ordering and placement decisions and instructions as the fire continues to burn or is impeded by the constructed fireline. The Simulator is effective for instruction at or below the 300-level of NWCG courses (Studebaker, 2003).

Certain specifications for computer hardware to run the system must be met, but none of these requirements are prohibitive. The system runs on a personal computer platform; a high-end workstation is not required. A Pentium 4 PC with a 1.6 GB processor, 20GB hard drive, and 512 MB of RAM running Windows 2000 Professional is more than adequate. The system does require a good video card such as Nvidia's GeForce 4600 Ti with 128 MB of memory (Harless, 2002).

Building the 3-D Fire Simulator was expensive and time-consuming. Approximately $1.4 million USD will have been spent on the project by the time it is completed, and about six years will have elapsed from the start of research and development began to completion.

Video-based simulation. The U.S. Forest Service's San Dimas Technology Development Center (SDTDC) developed this CD-ROM-based simulation to support command and control training. This simulation also makes use of human role players and simulation scripts, with the goal of prompting students to make decisions as fire ground commanders in a simulated fire situation. The fire propagation model used for this simulation is based on FARSITE (Fire Area Simulator). A two-dimensional topographic map of the fire area displaying the growing fire perimeter can be viewed by students during the simulation (Bambarger 2003).

Although no special computer equipment is required aside from a second video card, audio equipment is needed. An audio mixing board and tape player are needed for the sound effects. Radio traffic can be handled in one of two ways: either with handheld radios or with an "integrated radio set" that connects trainees to the role players via headsets and microphones. Purchase price for the integrated radio set is approximately $7,000 USD.

In general terms, there are some drawbacks to basing a simulation primarily on video images. If video is relied on too heavily then interactivity, user control, and immersion suffer. The user becomes more of an observer and less of a participant. Users, especially younger ones who have grown up with computer games that offer lots of user control, can become frustrated with a less interactive approach. (Powell 2002).

It is difficult to determine how many people are currently using this system. "Canned" simulations exist for two courses, NWCG S-200 and S-300 (Initial Attack and Extended Attack Incident Commander, respectively). In 2003, SDTDC shipped approximately 75 copies of the program to users in the U.S. The program, including software, took about three years to develop at a cost of approximately $23,000 USD. It takes role players approximately three "dry runs" with the system before they are comfortable working with it; simulation directors need to see the system run by an experienced person before running it themselves. It could take up to a week to develop your own simulation using this system (Bambarger 2003).

Scripted role -playing simulation. National Wildfire Coordinating Group command/general staff training courses S-420, S-520 and S-620 have been using scripted role-playing simulations for decades. These simulations require a large number of people to manage. The S-420 course, a week-long course geared toward Type 2 Incident Management Team trainees, can take a cadre as large as 35 people to manage a simulation for 6 8-person teams (Lengerich, 2003). This cadre consists of simulation leaders, dispatchers, other role players and evaluators. The team of trainees is sequestered in a room and given inputs simulating the inputs they would get upon arrival at a new incident, including an initial incident briefing, resource orders, maps and land status information, and line officer direction for management of the incident. The simulation lasts over 7 hours, during which time the team gets inputs from role players simulating members of the media, land owners, politicians, cooperating agencies, firefighters, contractors and a host of others. Toward the end of the simulation, team members are expected to produce a number of standard team outputs such as an Incident Status Summary and an Incident Action Plan.

The S-520 course, geared toward Type 1 Incident Management Team trainees, uses several simulations similar to the one used in S-420. For 12 teams of 7 people each, this course can require more than 85 people just for simulation support (Corner, 2003). Support is in the form of simulation team members and leaders, role players, coaches, logistics and evaluators. In the S-520 course, which lasts two weeks, simulations increase in scope and complexity as the training session progresses. The idea here is that as teams work together, they "gel" by perfecting their team processes and become capable of handling greater complexities and volumes of work. Evaluators are present during simulations at all times, monitoring team and individual performance and providing feedback in after action reviews. The final simulation in S-520 is the "grand finale" of the course, and for most trainees their performance in it is the difference between passing and failing the course.

The S-620 simulation is the same simulation as the S-520 final simulation, but trainees are in Area Command positions and must function as an Area Command Team overseeing a number of Type 1 Teams. Again, role players provide inputs to the Area Command trainees in the form of verbal inputs delivered in person or over the phone, or through other means such as maps, faxes and other documents. The simulation is designed so that the Area Command trainees also receive a number of inputs from the Type 1 teams, and part of the evaluation for the Area Command trainees covers the direction they provided to the subordinate teams.

A significant difference between these scripted simulations and the other simulations discussed in this paper is that the scripted simulations were designed specifically for teams of people involved in large incident management. The other simulations were designed primarily for individual decision makers such as incident commanders or other fireline personnel in charge of small units or small fires. However, with some ingenuity any simulation can all be adapted to work in a team environment. Learners involved in simulations at this level of the Incident Command System must engage in both analytical and recognition primed decision making.

Another difference between the scripted simulations and the others is that there are virtually no visual cues in the scripted simulations. Almost all of the inputs to trainees are verbal or written in the scripted simulations, with aerial photos and maps being the most graphical visual information.

Although this is a "low-tech" form of simulation, it is expensive due to the large number of personnel needed as role players, evaluators and coordinators. Not only do these personnel incur travel expenses, but they are also required to be away from their regularly assigned duties for up to two weeks at a time. Some of the other challenges associated with this type of simulation have to do with evaluation. With a team of 7 or 8 people involved in a hectic fire scenario, it can be difficult if not impossible for evaluators to "catch" all that is happening and see how all the trainees react to all of the inputs. Further, when conducting after action reviews with teams or individuals, there is no "replay" feature available; many of the perceptions of performance during the "heat of battle" are just that, and cannot be independently verified if the perception of an evaluator differs from that of a trainee. Space is another constraint on this type of simulation; many rooms are needed, not only for the teams but also for the simulators.

Sand-based simulation. Military organizations have been using terrain models for decades, both in training settings and in actual operations. Although sand tables had been used sporadically in the past in wildland fire training in the United States, there was not a concerted effort to incorporate this methodology into wildland fire training until after 2000. In November 2000, a group of wildland firefighters working on an initiative for wildland fire leadership development visited Marine Corps University in Quantico, Virginia. There, firefighters were given a comprehensive briefing on how the Marine Corps teaches decision making and tactics to its junior leaders. Marine officers are all required to complete a course of study for infantry platoon commanders at The Basic School at Quantico. Some of the training techniques used extensively at The Basic School are Tactical Decision Games and Sand Table Exercises.

Tactical Decision Games (TDG) are basically role-playing paper exercises; Sand Table Exercises (STEX) are TDGs using a three-dimensional terrain model. The primary purpose of these training techniques is to have firefighters practice making decisions and practice communicating their decisions properly. This type of practice is invaluable in that mistakes made in a low-risk training environment can be valuable learning experiences for students. This learning can later be applied on the fire ground where much more is at stake.

Under the auspices of an interagency leadership development effort, a handbook titled "Design and Delivery of Tactical Decision Games and Sand Table Exercises" was developed in 2002 for use by wildland firefighters. This guide is based on "The How To of Tactical Decision Games" by Major John F. Schmitt, U.S. Marine Corps. As stated in the Marine Corps document, the fundamental objective of Tactical Decision Games is to exercise decision making skills in a tactical context. Development of pattern-recognition skills is another objective of TDGs. Providing vicarious experience and opportunities to practice communicating decisions are further objectives (Schmitt 1996).

Tactical Decision Games and Sand Table Exercises are extremely simple, yet certain skills are required in order to facilitate them well. The facilitator must operate within a small set of rules. Paramount is the enforcement of a time limit; many TDGs last less than 15 minutes. In real life, most fire ground commanders are required to routinely make decisions under circumstances of extreme time pressure. The simulated environment must replicate this situation. Trainees must also be put into situations where they face a dilemma. For example, should the crew be split and work in two different directions from an anchor point? Limited information is another component of well-designed TDGs. On a real fire ground, most decision makers must operate with an incomplete set of information, yet they still must make timely decisions. In a TDG, a trainee must operate under these realistic constraints to come up with good solutions to realistic problems. An after action review caps the experience by allowing trainees and observers to discuss possible solutions, drawing lessons out of the collective experience. A skilled TDG/STEX facilitator must be able to keep the exercise moving and make the trainee feel the time pressure, without making the scenario appear unrealistic. He or she must also be able to subtly guide the after action review to ensure that the proper lessons are derived.

Compared to any other type of simulation, Tactical Decision Games and Sand Table Exercises are cheap, and they can be done just about anywhere. All that is required for a TDG is paper and writing instruments; often a map will be useful as well. For a Sand Table Exercise, all that is required is sand or dirt that can be shaped into a terrain model, along with a few props. Scale models of aircraft and fire engines are useful, as are green sticks to represent trees, blue string or webbing to represent creeks and rivers, wisps of cotton to represent smoke, and black and red chalk, spray paint or cloth to represent the fire area. Building a table for the sand raises the terrain model up to a level where students can comfortably view it from a standing position. All of this can be accomplished for a few hundred dollars.

Either a STEX or a TDG can be designed to cover a real historical incident. For example, a Sand Table Exercise can be put together where the terrain modelled is an actual piece of ground where a fire occurred. It is then possible to "re-fight the fire" as many times as desired, with students determining a variety of outcomes based on what action was taken. Tactical Decision Games have been used in conjunction with Staff Rides, where firefighters return to the scene of a significant fire event and reconstruct events that occurred there and decisions that were made. In this type of use, a TDG is a very effective way to get participants "inside the head" of the fire ground commanders who were on scene. Trainees can become very engaged in the learning experience when they are actively involved in trying to determine why certain decisions were made, what information a set of actions was based on, or what they would have done themselves in similar circumstances.

Summary

High tech or low tech training tools, on which end of the spectrum should a training organization invest? The answer is "it depends". This decision should be made based upon what the desired training outcome is, who the target audience is, the skill sets of available instructors, how much money is available, and how much time is available.

Generally speaking, the higher up the technology scale you climb in the simulation world, the more expensive it is and the steeper the learning curve for instructors. Yet there appears to be no evidence to support the idea that more expensive training solutions are necessarily more effective ones. Indeed, although the U.S. Marine Corps has access to some of the most sophisticated computer simulations currently available, they choose to use Tactical Decision Games and Sand Table Exercises because of their effectiveness as training tools for exercising decision making skills in a tactical context.

One challenge to the use of high tech training tools is the rapidity with which computing technology evolves. If software development cycles are lengthy, there is a very real chance that by the time the software can be used, the hardware to run it on will have changed. Another investment that is required when using high tech training tools is the time and effort it takes to bring instructors up to speed on the capabilities of a new system. Learning how to manipulate a new system to obtain a desired set of training results can be a challenge even for the most technologically literate of instructors.

Much ado has been made about the differences in younger generations that are now becoming a significant part of the general work force, and these considerations may drive some decisions on what types of training tools to use. The U.S. Department of Labor shows a continuing escalation of employees age 20 to 34 in management jobs (McDermott 2001). A number of traits are considered typical of these workers, among them techno-literacy. Today's video games feature high-end graphics and fast-paced action; will people from this generation tend to prefer 3-D animation-based training, and will they learn better from it than from other types of training? No definitive answer to this question exists, but empirical observations during the use of Sand Table Exercises with fire crews in the United States indicates that young people receive this type of training enthusiastically even though it is not computer-based.

Many training decisions revolve around "what can we afford" as opposed to "what would we like to have". If this is true for your organization, then simulations such as Tactical Decision Games and Sand Table Exercises may be worth institutionalizing. This can be accomplished relatively cheaply and quickly. If your organization is interested in high tech approaches, an approach to consider would be to partner with an organization that has already developed a system. This is what occurred when the U.S. Forest Service worked with the National Fire Academy to develop the 3-D Virtual Wildland Fire Simulator.

As technology evolves, computer-based simulations will continue to become easier to use, cheaper and more easily deployed. Most e-learning companies in the corporate market foresee online delivery and, eventually, handheld delivery as the next steps in simulation evolution. Right now, the pressing problems delaying this reality are bandwidth and the demands that computer-generated graphics place on networks and users' computers (Powell 2002). Technological advances notwithstanding, there will always be a nearly limitless supply of sand.

Bibliography

Bambarger, C., 2003. Personal communication. Technology Transfer Specialist, San Dimas Technology Development Center.

Caine, R.N., G. Caine, 1991. Making Connections: Teaching and the Human Brain. Banta Company.

Corner, R., 2003. Personal communication. Training Specialist, National Advanced Resource Technology Center, Arizona, U.S.A.

Gredler, M., 1994. Designing and Evaluating Games and Simulations: A Process Approach. Gulf Publishing Company.

Klein, G.A., R. Calderwood, A. Clinton-Cirocco, 1988. Rapid Decision Making on the Fire Ground. Army Research Institute Technical Report 796.

Lengerich, M., 2003. Personal communication. Training Specialist, Great Basin Training Unit, Idaho, U.S.A.

Powell, W., 2002. Like Life? *T+D* magazine, American Society of Training and Development. 56(2): 32-40.

Margolis, F.H., C.R. Bell, 1989. Understanding Training: Perspectives and Practices. University Associates, Inc.

McDermott, L., 2001. Developing the New Young Managers. *T+D* magazine, American Society of Training and Development. 55(10): 42-48.

Merriam-Webster, 1998. Merriam-Webster's collegiate dictionary. Merriam-Webster, Incorporated.

Schank, R., 1997. Virtual Learning: A Revolutionary Approach to Building a Highly Skilled Workforce. McGraw-Hill.

Schmitt, Major J.F., 1996. How We Decide. Designing TDGs, a Tactical Decision Games Workbook, Marine Corps University. 1-5.

Schmitt, Major J.F., 1996. The How To of Tactical Decision Games. Designing TDGs, a Tactical Decision Games Workbook, Marine Corps University. 6-10.

Studebaker, D., 2003. Personal Communication. Forest Assistant Fire Management Officer, Cleveland National Forest, California, U.S.A.