

HOW WILL THE DEVELOPMENT AND IMPLEMENTATION OF VIRTUAL  
REALITY AFFECT THE TRAINING FUNCTION IN A SMALL RURAL POLICE  
AGENCY BY THE YEAR 2005?

PROJECT

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This Command College project is a Futures study of a particular emerging issue in law enforcement. Its purpose is NOT to predict the future, but rather to project a number of possible scenarios for strategic planning consideration.

Defining the future differs from analyzing the past because the future has not yet happened. In this project, useful alternatives have been formulated systematically so that the planner can respond to a range of possible future environments.

Managing the future means influencing the future; creating it, constraining it, adapting to it. A futures study points the way.

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## Chapter I

### Development of the Issue

#### Introduction

Headlines across the world have brought attention to critical incidents that have been handled by law enforcement personnel regardless of agency size:

May 1, 1992	“3 students, 1 teacher killed while 84 students are held hostage” <sup>1</sup>
May 19, 1998	“3 officers shot dead; suspects hold hostages”
December 31, 1998	“Tourists used by captors as shields”
January 13, 1998	“Hostage stand-off ends at Tokyo Stock Exchange”
February 20, 2000	“Law enforcement criticized for their response to school shooting” <sup>2</sup>

Characteristics common throughout these situations are the involvement of innocent people not expecting to be involved in acutely life-threatening situations. Law enforcement personnel did not have prior knowledge the incidents were going to occur. There is an expectation by society that law enforcement personnel respond correctly to critical incidents. Police officers as well must depend upon the skill level they have obtained through training. Advancements in the field of virtual reality provide law enforcement personnel with realistic verifiable training environments.

According to Dr. Annette Sobel, a principal member of the technical staff at Sandia National Laboratory in Albuquerque, New Mexico, review of incidents occurring on a worldwide scale reveals change in the nature of incidents to which law enforcement personnel are responding. Law enforcement agencies in the United States are recurrently exposed to critical incidents such as hostage situations and terrorism, and are likely to be exposed to bio-chemical situations in

the future. Dr. Sobel believes advancements in technology, such as Virtual Reality (VR), provide law enforcement with an opportunity to train for such incidents in a controlled and safe environment.<sup>3</sup>

### History

Computer-generated virtual reality started in the early 1960's with engineers developing digital information for graphical displays for computer screens. In the late 1960's and early 1970's, aerospace engineers utilized the advancements in virtual reality to create simulated environments where pilots and astronauts could train while safely on the ground. The 1980's brought financial success to corporations such as Nintendo who utilized flight simulator technology to create virtual reality worlds to develop video games. With computer advancements, high-speed processors were capable of sophisticated graphics that made it exciting for the consumer. The production of the CD-ROM took place in the 1990's. This mass-storage medium further developed virtual reality.<sup>4</sup>

Other advancements included the data glove: a glove wired with sensors and connected to a computer system for gesture recognition. It is used for tactile feedback and enables navigation through virtual environment and interaction with 3-D products. Head Mounted Display (HMD) units utilize a set of goggles or a helmet with tiny monitors in front of each eye to generate images seen by the viewer as being three-dimensional. Other advancements included spherical projection systems and experiential, multi-user environments known as the

CAVE. CAVE is virtual reality using a projection device that uses walls and the ceiling to give the illusion of immersion.<sup>5</sup>

### Defining Virtual Reality

Virtual reality is a three-dimensional, computer generated simulation in which one can navigate, interact and be immersed in an artificial environment. Virtual is derived from the concept of “virtual memory” in a computer, which acts as an actual memory. Human beings respond well to three-dimensional images which allows us to interface with VR technology so that we can experience the virtual environments in real time.<sup>6</sup>

### Scientific Advancements in Virtual Reality

Interactions between humans and computer technology can occur by the use of different VR modes. Virtual reality consists of the following eight modes.

1. Subjective Immersion
2. Desktop VR
3. Projected VR
4. Spatial Immersion
5. Immersive VR
6. CAVE
7. Telepresence
8. Augmented

Subjective immersion refers to the user viewing the scenario from a remote position. Interaction with the scenario is performed via computer monitors, keyboards, mouse controls and other computer hardware as needed. Simulation software provides three-dimensional displays. Desktop VR is the most commonly utilized mode for virtual reality. It is applied in games and

CAD/CAM interactions, for example a CD-ROM bomb threat-training simulator. Projected VR simply consists of an image of the real user overlapped onto a computer-generated environment or situation. A tracking device details the use's actions and inserts them into the virtual environment to simulate actions and reactions.

A more complex form of VR is spatial immersion. This process allows the user to interact with the simulated environment and feel the accompanying sensations. Special equipment is required for this process. The user must wear special equipment to permit the perception of existing objects and events as they occur in relation to the user's movement. Spatial immersion is best utilized where the explorations of spaces and objects within those spaces are the goal. Immersive VR takes the immersion to a deeper level. The user must wear a head-mounted display to facilitate correspondence of user's movements and environmental feedback. CAVE virtual reality is a small room where multiple users can share the experience from different angles via the projection of a computer-generated world onto the walls. Telepresence utilizes robotic and electronic sensors controlled by the user in a remote location. An example of this is space or deep-sea exploration. Augmented VR is virtual reality enriched with virtual objects and items, and is best suited for abstractions like database navigation or science fiction.<sup>7</sup>

#### VR Technology Specific to VRaptor

Another technology advancement in the area of virtual reality is VRaptor (Virtual Reality Assault Planning, Training, or Rehearsal.) Dr. Sharon Stansfield,

a senior member of the technical staff at Sandia National Laboratories, developed this technology. Dr. Stansfield has a Ph.D. In Computer Science and has focused her research toward machine intelligence, cognitive models of robotic perception, and medical image interpretation. VRaptor is a software program that is capable of being operated on a standard personal computer with additional virtual reality hardware, enabling trainees to work individually or as a team to experience training exercises.<sup>8</sup>

VRaptor technology specific to the VRaptor system is a component of immersive VR. VRaptor involves a type of immersive display system that enables an individual to experience computer-generated environments through visual, auditory, and tactile inputs.<sup>9</sup> The Head Mounted Display (HMD) is a helmet-like device containing a screen that displays a computer-generated visual scene and uses headphones for the audio effects. The HMD has a tracking system that interacts with the computer so the system can respond to the user's actions, i.e., looking down or to the right, and alters the visual scene of the user based on this interaction. Other technological advances incorporate a sense of touch or haptic interfacing to enable the computer system to generate feedback from the environment the trainee is experiencing.<sup>10</sup>

Dr. Sobel stated that the only limitation to applying virtual reality as a training tool is one's imagination.<sup>11</sup> An advantage of VR technology in comparison to multi-media simulation systems is the ability of the trainee to interact with training environments. This form of training is exceptional for many reasons. Its immersive quality allows trainees to encounter the sensations of

sight, sound, and touch. Because it is interactive, actions have immediate reactions and consequences, including virtual death of the trainee. Virtual reality customizes team training via programming by an instructor who can vary roles, moves, and placement of VR characters. Also, the comparatively small package allows for movement to onsite crisis locations for realistic simulation training prior to actual action. Finally, VRaptor can replicate hazardous situations for the development of tactical team skills and individual judgement in a safe manner.<sup>12</sup>

Law enforcement officers currently receive the majority of their critical incident training through scenario exercises. Though these exercises are helpful, they are not capable of creating real life situations, such as officer involved shootings, or measuring the officer's reaction time to a potential hazardous situation. In many small agencies the occurrences of these crises are too infrequent to maintain acceptable levels of skill, judgement, and preparedness. Future projections of increased terrorist activity, violent crime, and biochemical warfare illustrate the need for improved training. Crisis simulations and immersion by virtual reality provide an excellent training resource for officers of agencies of all sizes.

## Chapter II

### Forecasting the Future

A group of individuals with different educational backgrounds was formulated to examine the feasibility of virtual reality being utilized as a method of training police officers. This group focused on trends already experienced by law enforcement and what potential events could influence the outcome of virtual reality as a training tool.

#### The Nominal Group

The Nominal Group Technique (NGT), used to develop future scenarios for this project, brought together a wide range of experience and knowledge enhancing the opportunity to expose different perspectives. The group identified trends and events they believed could impact the issue in the future. The panel was comprised of seven people. The group was composed of individuals who had expertise in areas that could impact the development and implementation of virtual reality. The NGT panel was comprised of individuals representing expertise from the following areas: computer science engineering, local schools, National Consortium for Justice Information and Statistics, POST Training Division, clinical psychology, and a lieutenant from a police department.

Approximately one week prior to the scheduled NGT process, each of the participants received a packet containing materials clarifying the issue. The packet included research information and definition of terms relevant to the NGT

process. At the onset of the NGT process the issue statement and definitions concerning trends and events were reviewed.

Definitions	
<input type="checkbox"/>	<u>Trends:</u> A series of events strung together. They may be internal or external to the organization, should represent major areas of relevance to the issue and should be clearly stated in terms defined and understood.
	<u>Events:</u> A single incident that could have a significant impact on the issue. Events must be discreet occurrences a future historian would, in retrospect, be able to determine neither did occur. Events must include those with low probability but which would greatly impact the issue if they occurred. Events may be internal or external to the organization and have not occurred in the past.

Definitions presented to the NGT panel  
Table 2.1

The NGT process consisted of each member generating their individual ideas as they related to the definition of trends and events. The group examined their individual idea and its relevancy to the issue statement. Each member then provided each idea, and as a group, 63 trends were identified (Appendex A). The group then selected 8 trends they felt had the greatest potential of impacting the issue.

The group then assessed the value each trend had on the issue during time frames of five years previous to today, five years from now, and ten years from now. Next, the members of the group individually assigned a numerical value for each trend reflecting what they believed to be its potential impact on the

issue. The values in columns 2-5 represent the impact the stated trends are believed to have on the issue. The value 100 in column two represents the impact of the trend today. The value in column six represents the group's level of concern about the trend. The 8 trends and the median values assigned by the group are reflected in Table 2.2.

Trends	- 5 years	Today	+ 5 years	+10 years	Concern (1-10)
(1) Budget	150	100	100	10	5
(2) Coordination of virtual reality efforts with other agencies (federal, state, county, and private sector)	75	100	125	150	6
(3) Cost of virtual reality technology	200	100	75	50	10
(4) Constant reevaluation of VR and its relevancy to law enforcement	80	100	125	175	7
(5) Teaching and reinforcement of proper police actions/decisions	50	100	150	200	9
(6) Human interpersonal communication (less human interaction)	75	100	150	175	7
(7) Public expectations of law enforcement	50	100	125	200	8
(8) Changes in virtual reality technology to meet training needs	75	100	125	130	10

Trend Analysis  
Table 2.2

The nominal group identified the following trends most likely to impact the development and implementation of virtual reality as a training tool for small rural law enforcement agencies.

1). Budget

The NGT panel felt the initial cost of virtual reality technology would be significant. The panel also felt that through government assistance, grant

funding, pilot projects, and the formation of partnerships with military services the cost factor would not be a significant concern.

2). Coordination of virtual reality efforts with other agencies (federal, state, county and private sector).

The NGT panel felt the best way to implement VR training would be through regional training locations. This would provide police officers from large and small agencies the ability to attend VR training. The physical location of the regional training site would increase the participation of police officers located in remote areas of the state. Also by coordinating federal, state, and local law enforcement entities the training experience would be optimum for all organizations.

3). Cost of virtual reality technology.

The NGT panel voiced concerns regarding the cost of new VR technology. The group felt that the overall cost of VR technology would decline over the next five to ten years. However, the group was concerned about the initial expense of upgrades as advancements in VR technology.

4). Constant reevaluation of VR and its relevancy to law enforcement.

The NGT panel felt it would be important to formulate a state committee that was comprised of individuals from the following backgrounds: law enforcement experts in the area of officer safety, education, psychology, legal advisors from the Attorney Generals office, technological experts and POST advisors. The purpose of panel would be to share their areas of expertise to ensure the best possible training was provided.

The panel also felt that over the next five to ten years legal questions concerning virtual reality, as a training tool would become part of legal arguments for both criminal and civil cases. Therefore it is important we examine all areas of training to ensure we develop the best training program possible.

5). Teaching and reinforcement of proper police actions/decisions.

The panel members felt it will be critical to develop a curriculum that specifically examines the decision making process of a police officer and the actions taken by the trainee. The panel suggested the curriculum be monitored by POST just as all other law enforcement training. The overall concern expressed by panel members was how law enforcement officials would monitor trends so training would reflect accurate training environments.

6). Human interpersonal communication (less human interaction).

The one concern the panel expressed is the lack of interaction with other police personnel in a VR training environment. The panel members felt that as more VR training was implemented and expanded to different facets of law enforcement that interaction between police officers in a training environment would be lost. A number of panel members felt this could be minimized by closely reviewing training curriculum.

7) Expectation due to the capability of advanced training technology.

Panel members felt that due to the technological training advancements of VR which enable a police officer to interact with the training environment that jury members may examine an officers actions more closely because of an expectation of fewer mistakes.

8). Changes in virtual reality technology to meet training needs.

The panel felt that it would be critical for law enforcement to continually monitor software and hardware changes to ensure we have the best training tools possible. If these changes were not monitored the panel felt the training material would become antiquated and there would be a risk in losing credibility.

The nominal group repeated the same process to identify potential events. The NGT panel identified forty-six events it felt would impact the issue. The group identified nine events out of the forty-six that it felt had the greatest significance on the issue. Values were assigned to each event using the same process as outlined for trends. The values in column two represent the first year the event is likely to occur. The values in columns 3-4 represent the probability of the event occurring within five and ten years. The values in column five represent the impact of the event on the issue and the group's opinion as to whether the impact will be positive or negative.

The identified events and the median values assigned by the group are reflected in Table 2.3.

Events	Yr. > 0	5 years	10 Years	Impact (-10 to +10)
(1) Adverse court ruling forces VR training	1	75	100	+10
(2) Significant negative economic change for United States (depression)	5	50	80	-7
(3) Unexpected consequences (side effects to humans, i.e., motion sickness)	6	0	50	-1
(4) Development of on-line VR training	10	0	25	+9
(5) Governor signs bill offering VR	5	20	50	+9
(6) Federal government develops VR training	4	20	80	+8
(7) Development of 100% effective non-lethal device	3	60	80	+10
(8) Law enforcement personnel demand VR training	5	50	80	+7
(9) Creation of device that allows VR to interact directly with the brain	2	10	20	+8

Event Analysis  
Table 2.3

The NGT panel discussed the following 9 events.

1). Adverse Court Ruling forces virtual reality training.

The panel discussed the likelihood of VR training becoming part of legal arguments in court proceedings. The panel felt that by law enforcement taking the initiative to implement VR training, and ensuring the curriculum was well developed that law enforcement could potentially control and avoid an adverse court ruling. The panel felt that if the court had to mandate VR as a training tool the impact on law enforcement would be viewed as negative.

2) Significant negative economic change for the United States (depression).

The panel members said they thought if the United States experienced a depression that government funding for VR training would stop. Members also felt this could have a negative impact on meeting the training needs of law enforcement personnel. Some panel members felt it would be difficult to establish new training programs that could compare to VR training exercises. The panel also felt that because of the lost ability to train officers with VR that liability issues would develop.

3). Unexpected consequences (side effects to humans, i.e., motion sickness).

Panel members felt that because some individuals have experienced negative physical and psychological reactions to VR training that this could potentially have a negative impact on VR as a training tool. Some panel members anticipated worker compensation claims due to use of VR equipment. Claims could potentially include both physical injury and psychological issues.

4). Development of on-line virtual reality training.

Panel members felt that development and implementation of on-line VR training would make the technology readily available to all law enforcement agencies regardless of agency size or geographic location. Members also felt this would positively impact training opportunities.

5). Governor signs bill that will finance virtual reality training for law enforcement personnel.

The panel felt that if the governor signed a bill that would fund software, hardware and advancements in VR technology that law enforcement would have

confidence in the commitment to VR training. Some panel members felt communities would feel a sense of confidence in law enforcement organizations because of the commitment to train law enforcement personnel.

6). Federal government develops virtual reality training

The panel suggested that if the federal government developed VR training for police personnel they would have control over the training exercises and curriculum. This could minimize the potential of anti-police groups reviewing police training techniques. The panel also thought the federal government could combine some of the hardware uses with those currently used by armed forces which could minimize cost.

7). Development of a 100 percent effective non-lethal device.

Some panel members felt that if non-lethal devices were developed and found to be one hundred percent effective that the impact of law enforcement would be positive. Members felt that non-lethal devices would change the perception of law enforcement. Virtual reality would continue to be used as a training tool especially in the area of logistics and tactical planning.

8). Law enforcement personnel demand virtual reality training.

Panel members felt that if law enforcement officials did not see the value of VR training that police associations could start approaching organizations such as the California Police Officers Association to pressure support for VR training. Some panel members felt if law enforcement personnel took the initiative to implement VR training it would assist in protecting officers along with government entities in civil litigation cases.

9). Creation of a device that allows virtual reality to interact directly with the human brain.

Some panel members discussed technological advancements and the potential of implanting a microchip in a police officers brain, which was capable of interacting VR technology. This would potentially allow the officer to experience thousands of different sceniors increasing the likelihood of responding correctly to the given situation. It could also save police officers, citizen lives, and reduce exposure to civil and criminal liability.

Next in the process was a cross-impact analysis. Events were assessed to have either positive or negative impact on trends. The cross-impact analysis demonstrated the impact events potentially have on trends. By analyzing the relationship between an event and trend, and impact can be made by encouraging or discouraging an event. The cross-impact values were converted to median scores.

Events	Trends							
	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
E-1	3	7	7	4	5	0	-2	6
E-2	-8	-1	-6	-1	3	0	-1	-5
E-3	6	5	5	7	3	5	4	6
E-4	5	9	8	8	9	4	9	9
E-5	10	9	5	4	9	3	8	7
E-6	5	6	9	7	7	2	7	9
E-7	6	5	4	5	7	4	10	7
E-8	4	3	3	6	7	2	5	4
E-9	3	5	7	4	10	7	3	8

Cross Impact Analysis

Table 2.4

The cross-impact analysis indicated that Event 1 (Adverse court ruling forces VR training) could have a negative impact on law enforcement and how the public views our profession. One of the issues discussed that would be paramount would be the circumstance surrounding the adverse court ruling. Event 2 (Significant negative economic change for the United States – depression) would significantly impact law enforcement budgets. The group indicated if Event 2 occurs it would have a negative impact on Trend 3 (Cost of virtual reality technology continues to escalate) and the funding for technological advances would not be available, causing advances to stop. Trend 8 (Virtual reality technology is continuously upgraded to meet law enforcement needs) would be greatly impacted due to funding not being available for upgrades. Event 4 (Development of on-line VR training) could positively impact Trend 2 because of coordination between agencies (federal, state, county, and private sector.) Other trends that would be affected positively if Event 4 occurred are Trends 5, 7, and 8. Trend 5 (Teaching and reinforcement of proper police actions/decisions) Development of Event 4 would provide all law enforcement personnel access to new issues, legal interpretations, and mandates immediately. This would also be a cost-effective means for officers receiving training, thus lessening overtime expenses. Trend 7 (Public expectations of law enforcement) by the very nature of our profession and the responsibility entrusted to us, the public holds us to a higher standard and level of accountability. Development of on-line VR training would enhance officer training, which would help our overall profession in its preparation to meet public

expectations. Trend 8 (Virtual reality technology is continuously upgraded to meet law enforcement needs.) If Event 4 were to occur, we would have training information readily available to ensure our personnel were well trained. Event 5 (Governor signs bill offering virtual reality) would have a positive impact on Trend 1 (budget) because police managers would know they were going to have their officers trained and there would be provisions in the bill signed by the governor to cover training expenses. This would ensure small law enforcement agencies received the same training as larger police departments. Event 5 would impact Trend 2 because the additional funding would enhance training capabilities, thereby enhancing the cordoned virtual reality training efforts between federal, state, and county entities. Trend 5 would be affected positively because the bill would ensure funds were available so officers could receive the training, which teaches and reinforces proper police actions/decisions. Event 6 (Federal government develops virtual reality training) would have a positive impact on Trend 3 (cost of VR technology continues to escalate. The federal government would be covering the expenses surrounding technological development and advances in virtual reality. This would greatly increase the likelihood of new technological advances. Trend 8 (Changes in virtual reality technology are continuously upgraded to meet training needs) would be greatly impacted because the federal government would have the financial means to upgrade VR systems to meet training needs. Event 9 (Creation of a device that allows VR to interact directly with the brain) would have a significant impact on Trend 5 (Teaching and reinforcement of proper police actions/decisions). The individual's

ability to analyze, comprehend, and process sound decisions would be phenomenal.

### Scenarios

The examination of virtual reality and its feasibility as a method of training for law enforcement generated a wide range of possibilities. The NGT process laid the foundation for a variety of possibilities that could result because of the impact an event could potentially have on a trend. Several issues were discussed during the nominal group exercise. The scenarios are projections into the future that are based on history, nominal group input, cross impact analysis, and potential events that could effect the implementation of virtual reality as a training tool.

### Optimistic Scenario

It is June 7, 2005, and the headline of the Sacramento Bee reads "Virtual Reality is Reality." Governor Wellington signs a bill providing law enforcement with a technological tool that will enhance the training environments of law enforcement personnel. The bill includes provisions for technology development, and Governor Wellington has requested a task force be comprised of researchers in the field of virtual reality, computer science, law enforcement, and members of the Commission on Police Officer Standard and Training (POST.) Members of the task force will review virtual reality technology developed by the federal government and private industry, and evaluate which programs will best fit with the training needs of law enforcement.

Governor Wellington stated today in a press conference, “Because of the high risk nature of law enforcement and the expectations we, as the public have, we have a responsibility to make sure our police personnel receive the best training possible.” This training effort will be state-wide and will include all police officers throughout the state, regardless of the size of the agency. The training environments will be set up regionally and will include technology that is capable of being transported from various locations in the field. The governor stated that the Department of Defense is committed to assisting with the development of this program and has been assured of the funding necessary to have a state-of-the-art virtual reality training program. The Department of Defense has worked with our armed forces and developed VR programs to meet the training needs of their staff.

Dr. Sobel of Sandia Laboratory considers VR an incredible training tool. It provides individuals with the means to customize their training for critical decision making in a safe controlled environment. Catastrophic outcomes due to poor judgement can be reduced. Training via VR is limited only by the imagination of those utilizing it, and can even be utilized by academies to develop interview techniques for crime scene processing.

### Pessimistic Scenario

It is June 7, 2005, and the depth of our depression has exhausted our nation. Scientists Drs. Sobel and Stansfield, Sandia Laboratory, spoke at a federal review committee today in an attempt to convince the committee members that though our nation is in the midst of the most severe depression it

has ever seen, funds for this project need to be approved. Dr. Sobel told committee members the technology was completed and all that was needed was funding for the hardware units and additional software for each unit. Dr. Sobel indicated the cost for each unit would be approximately \$200,000, plus the additional software cost of \$75,000. The Commissioner of POST was also present during the presentation and advised the committee members his organization had completed all training assignments for the “Virtual Reality is a Reality” project and was just waiting for the hardware and software.

After all the presentations were made, the committee took a short recess and then reconvened. The chairperson then advised Drs. Sobel and Stansfield that the committee was very impressed with the technology they had developed and believed it was a needed training tool for law enforcement. However, the federal government would not be able to provide any type of financial assistance. The chairperson said, “We have a country that is in financial ruins, with little hope in sight, and we cannot justify this type of spending in our current atmosphere.”

#### Surprise-free Scenario

It’s June 7, 2005, and Police Chief Richard Doscher is attending a meeting at the request of Bragg and Associates, the Northern California Cities Self-Insurance Fund for 20 small cities. The CEO of Bragg and Associates told those in attendance that in the last five years the amount paid out in claims related to law enforcement has more than tripled. Bragg and Associates stated it had paid out just under \$11 million for claims involving law enforcement. The areas that

appear to have the greatest degree of liability are vehicle collisions, vehicle pursuits, civil rights violations, excessive force, and false arrests.

In addition to the chiefs of police in attendance, Bragg and Associates also included city managers, city attorneys, and area training representatives from POST. The Bragg representative advised those in attendance they could not afford to continue to insure the cities if these costs continued to increase at the rate they had over the previous five years. As a result of those increases, members of the management team at Bragg and Associates started to look at the areas identified above and brainstormed possible means of decreasing liability for police agencies. One of the members suggested they contact POST to discuss training possibilities. POST suggested the use of virtual reality to train police officers because of the safe environment the technology provides.

The spokesperson for Bragg stated they would like to start a pilot program with a coordinated effort that would include POST representatives, chiefs of police, and training officers, to look at a regional training location so small law enforcement agencies would have access to training. Bragg is estimating they will contribute approximately \$400,000 in hardware and software, while POST would provide a reimbursement for Plans I and III. This would allow personnel from small law enforcement agencies to complete the training as quickly as possible.

The advancements made in virtual reality technology would enhance law enforcement ability to provide realistic verifiable training to its personnel.

This technology provides the ability to teach and reinforce proper police actions and decision-making processes. Military armed forces have already successfully implemented VR training. This success will assist civilian law enforcement in implementing and organizing VR as a training tool.

By utilizing the regional training concept locations, virtual reality training would be accessible to all law enforcement agencies regardless of their size and location. As discussed during the NGT process and the surprise free scenario, this training may help reduce potential civil liability payoffs. By having better-prepared officers, the credibility of the law enforcement profession would enhance, instilling public trust.

### Chapter III Strategic Plan Transitional Management

#### Defining the Future

This strategic plan will define strategies important to developing, managing, and implementing virtual reality training for officers in a small law enforcement agency by the year 2005. To enhance focus, a vision was created to describe the future. The vision defines where we want to be in the next three to ten years.<sup>13</sup> The task of this project is to examine how the development and implementation of virtual reality would affect the training function in a small rural law enforcement agency. The Yuba City Police Department is comprised of 44 sworn police officers, and meets the definition of a small law enforcement agency.

The Yuba City Police Department has established a reputation throughout the law enforcement profession as an agency that is balanced between the efforts of Community Oriented Policing and Problem Solving, as well as a strong commitment to technological advancements to increase the quality of service provided to the community. The Chief of Police has consistently encouraged staff and officers to see the strength in knowledge and to keep a watchful eye toward those events that could affect our organizational direction.

This strategic plan will define strategies important to law enforcement staying current in an environment of constant influx. A vision was created to describe the future. The vision allows members of the organization to look forward from where they are to where they want to be.

## VISION

### WE ARE COMMITTED TO BEING PREPARED . . .

We set the pace for law enforcement; we are futurists who are prepared for constant change in all areas of our profession. We are a learning organization that challenges reality and convention, creates opportunities, share discovery, encourages experimentation and excels at self-examination. We have a commitment to our staff and community to be prepared – therefore we reach for the future.

The development of the strategic plan is the creation of the organization's mission statement. The mission statement translates the ideas expressed in the vision and communicates objectives essential to goal accomplishment.

## MISSION STATEMENT

The mission of the Yuba City Police Department is to work in partnership with the community. We are committed to a vision of the future that ensures quality, integrity, accountability, and cooperation. We encourage new ideas, and explore technology to meet society's changing issues.<sup>14</sup>

## VALUES

### “A Reflection of our FUTURE”

Future means visualizing what has not yet been seen. We are committed to keep the pulse on trends affecting law enforcement and a watchful eye on potential events that could affect our future.

Understanding the continual changes our society and community will experience and how we will anticipate, plan, and respond.

Training is an investment for successful outcomes.

Utilizing the talents of our staff and encouraging their input and creativity so we can perform at an optimal level.

Recognizing when we need to make changes so we can better respond to community needs as well as meet the needs of our staff.

Evaluate our organization to ensure we are on the cutting edge of technology.

## Organizational Analysis

In preparing for the implementation and/or organizational change, there are key facets that need to be analyzed. This can be accomplished by gaining an understanding of our organizations internal workings, and matching the internal Strengths and Weaknesses with environmental Opportunities and Threats. SWOT analysis is a systematic means to identify strengths and weaknesses involving the implementation of Virtual Reality into a small law enforcement agency.<sup>15</sup>

The analysis process should include examination of internal weaknesses, external opportunities, and external threats.

### Internal Weaknesses

- Organization will need to be able to depend on consistent funding.
- If technology is not realistic, officers will not find the training tool credible and will lose interest.
- Officers will be concerned about finding a balance between technological training exercises and training exercises set up in the field.
- Need to include all units, if possible, in this type of training, i.e., Detective's Division, Traffic Education and Enforcement, Field Operations, and the Tactical Team, or levels of resentment could develop.
- If there is a high rate of turnover in the agency, consistent training may become an issue.
- If there are physical side effects from this technology, i.e., motion sickness, officers are going to want assurance of other training tools.

### External Opportunities

- Positive press relations.
- City council may encourage the police department's involvement in VR training because it wants the city known as progressive and open to new technology.
- Potential recruits may be looking for law enforcement agencies that are supportive of technological advancements.
- Depending on the outcome of court cases, the District Attorney may be supportive of technology.
- Reduction of claims being paid by city and rise management insurance companies.

### External Threats

- Lack of funding to ensure technology will be developed for law enforcement.
- Media distorting the purpose of VR.
- Changes in technology occur so quickly it makes it difficult to keep developers' efforts coordinated.
- Misuse of technology, i.e., terrorist group uses technology to undermine/plan against police.

### Internal Strengths

- Because we have established ourselves as technological agency, officers are geared toward accepting new training advancements.
- Administration/management and supervisors are supportive of advancements made in the area of training.

- There are benefits to being a small law enforcement agency – we have been able to see results and outcomes from training quickly.
- The agency has strong external relationships, so we will be able to influence those relationships.
- Enhanced training could better prepare officers and save lives.
- Capability of exposing officers to a variety of different situations, increasing their experience and enhancing their judgement.
- Excellent record of training documentation for special interest groups and courtroom presentations.
- Computer companies may see an advantage in investing in the public sector.

By analyzing and identifying organizational internal strengths it will assist in identifying external opportunities and external threats so your analysis will be complete.

### Stakeholder Identification

The identification of stakeholders and an analysis of their specific concerns and expectations are critical to the strategic planning process. A stakeholder is defined as individuals or groups that are impacted by what we do and individuals or groups who can impact what we do. It is believed that the state of an organization, at a given point in time, is the result of the interactions with and among stakeholders.<sup>16</sup>

#### City Council

- Want to minimize costs associated with virtual reality training
- Leadership philosophy may change after elections
- If training/technology is too controversial council may not support. However, if it is positive they will support

### City Attorney / Risk Manager

- Depending on court rulings, this technology may or may not be supported
- If this training assists the city in liability cases it will be supported and encouraged

### City Manager

- Will be concerned about council and community reactions
- Will want technological training if proven to lower the amount of money paid out against cities for cases involving questionable decisions made by police officers
- Will want to be assured there will not be any hidden expenses
- Will want to know if the city is expected to fund any part of the training

### Chief of Police / Police Management

- Want competent people
- Want police personnel to be able to train for infrequent events so they react/plan correctly
- Will want policy/procedures for training
- Want to protect officers and city from exposure to liability
- Will be concerned as to what the City Council, City Manager, and the community think of the training tool
- Will keep the pulse on what is occurring throughout the state regarding the training topic to ensure there are not unforeseeable developments
- Will want to know what value officers place on the training
- Will want to know the budgetary plan, i.e., federal and state governments

### Trainers / Supervisors

- Want realistic, verifiable training
- Want to develop competent people
- Supervisors would find the technology helpful for practicing infield supervision of calls in progress

### Police Unions

- Will be watching court rulings involving Virtual Reality training
- Will be concerned if there are physical side effects as a result of training
- Will instructors be chosen from individual agencies, i.e., available overtime

### Peace Officer Standards and Training (POST)

- POST will be dependent on funding, i.e., federal government/Department of Defense and/or State of California
- Will be concerned about setting up a statewide program to ensure all officers receive training whether they are affiliated with a small or large law enforcement agency
- They will be monitoring legal cases as they develop throughout the state

### Police Officers

- Will support training if they view it as valuable
- Will want technology to be realistic, not arcade-like
- If they value training they will want regular scheduled training
- Will want POST to support and help acceptance of training
- If there are officers who are not able to go through training due to a physical condition they want other training available to cover the same training topics

### Developers of Virtual Reality Technology

- Will want to know there is a market for their product
- Will want assurance from government they will be financially committed

Stakeholders can be internal or external to the organization. They can also be directly, or indirectly involved with the issue. Below is a list of stakeholders and their relationship to how the development and implementation of virtual reality will affect the training function in a small rural police agency by the year 2005.

Stakeholders	Assurance of Funding	Realistic Verifiable Training	Competency	Availability of Training	Community Reaction	Liability
City Council	X		X		X	X
City Attorney Risk Manager		X	X	X		X
City Manager	X				X	X
Chiefs of Police Managers	X	X	X	X	X	X
Academy Coordinators	X	X	X	X		X
Supervisors		X	X	X		
Police Unions				X		
Police Officers		X		X		
POST	X	X	X	X	X	X
Community Members	X					
Developers of VR Technology	X	X	X	X	X	X

Stakeholders  
Table 3.1

### Development of Alternative Strategies

As part of the strategic plan, leaders need to educate stakeholders. This educational process will assist in the development and implementation of alternative strategies. Below are three possible strategies which could assist in the development and implementation of virtual reality as a training tool.

Strategy 1 City government officials / Chiefs of Police need to empower themselves through legislative means.

This strategy involves working through such entities as Cal Chiefs, League of California Cities, POST, legal advisors, risk managers, and the Attorney

General's office so they can educate and communicate the value of investing in the training needs of police officers and the many diverse situations they face.

Strategy 2 An in-depth educational process needs to be designed / outlined for all stakeholders.

This strategy allows law enforcement an opportunity to emphasize the type of image they want projected involving virtual reality and training. This can help stakeholders see value in the technology and how law enforcement officials are planning for the future. Another positive aspect of this is by planning an education / marketing strategy it can help formalize the impact on stakeholders simultaneously.

Strategy 3 Scientific developers of VR technology need to work with risk managers and focus on training areas where financial liability issues have been identified, as well as with POST and personnel involved with training.

The Northern California Cities Self Insurance Fund (NCCSIF) is an insurance company which represents 20 small cities, covering liability issues and suits involving decisions by law enforcement personnel. Between 1994 – 1999, NCCSIF paid out nearly \$4 million. The areas of greatest pay out were vehicle collisions, pursuits, civil rights violations, excessive force, and false arrests.<sup>17</sup>

### Transitional Management

A successful Transitional Management Plan must encourage innovative ideas, creative problem solving, and be flexible. This type of leadership style is critical because it encourages involvement at the onset of thoughts of change.<sup>18</sup>

If the organizational administrative culture is one of inclusion and encourages involvement, i.e., coaching and mentoring. People will be prepared to help formulate the foundation for change to occur. By educating and encouraging staff they become empowered to move the organization from where it is currently to the desired vision of the future.

### Organizational / Operational Change

Prior to making organizational change, it is paramount to identify the reasons for needed change. For a successful outcome employees must understand why the desired change is necessary. If they do not understand why change is important for future organizational success, the change will not be supported.<sup>19</sup>

### Critical Mass

One of the dynamics of organizational change is critical mass. These are the individuals within the organization who are change agents because they see value in the change and can support the desired outcome. Once there is a sufficient number of individuals supporting the process of change they become the Critical Mass. It is important to identify the stakeholders within the critical mass because they will have a great deal of influence. The following is a list of individuals or groups whose active support and commitment are necessary for successful implementation of the desired strategy:

- Chief of Police
- City Council
- Commission of Peace Officers Standards and Training
- Police Management

- City Manager
- Field Training Officers
- Federal Government allocation of funding, i.e., grants
- Line staff seeing value in technological training

### Responsible Leadership

This is an age of changing workplaces. Traditional ways of getting work done are disappearing as organizations flatten and transform in response to competitive demands and stakeholders' changing needs. Increasingly, it is necessary to leave the security of narrowly defined roles and join others in a task. To work productively within dynamic and diverse organization, a key competency we now required is the ability to partner quickly and effectively.<sup>20</sup>

The transitional plan must:

1. Educate staff toward future events and how they interact with the trends of our profession.
2. Form task groups to work through potential issues and problems.
3. Meet regularly with groups to provide guidance, support, and help with trouble-shooting.
4. Keep the pulse of line staff, and recognize accomplishments as the transitional process is worked through.
5. Monitor transitional time lines and keep in mind the importance of remaining patient. Stakeholders need to know the desired time frame for change, and that flexibility is just as important as accountability.

Law enforcement organizations have experienced significant changes over the past century. Achieving a successful, inclusive organization in the future depends on the vision created by our leaders today. New styles of leadership, thinking, communication, problem-solving, and strategic planning will be critical to success.

Increasing incidences of severe crises necessitates law enforcement develop improved means of training for personnel to handle these situations while minimizing human and material loss. Current training methods fail to keep law enforcement personnel in small agencies adequately trained and prepared to handle critical incidents. Virtual reality offers a cost-effective and thorough means of accomplishing this training. Leaders of these agencies must facilitate and engage change to maintain their effectiveness into the future.

## Chapter IV Implications

### Training Benefits Involving Virtual Reality

Law enforcement officers are often faced with making decisions involving high-risk environments with little or no experience. The advancements in virtual reality technology enable personnel to engage in realistic situations that develop skills that are useful, for example, street survival skills, and arrest procedures involving virtual criminals.

The following scenario illustrates a critical situation where VR can be utilized:

“A late night police pursuit of a drunk driver winds through abandoned city streets. The short vehicle chase ends in a warehouse district where the suspect abandons his vehicle and continues his flight on foot. Before backup arrives, the rookie patrol officer exits his vehicle and gives chase. A quick run along a loading dock ends at the open door to an apparently unoccupied building. The suspect stops, brandishes a revolver, and fires in the direction of the pursuing officer before disappearing into the building. The officer, shaken but uninjured, radios in his location and follows the suspect into the building.”<sup>21</sup>

An advantage to training with virtual reality technology is the trainee is able to experience real life scenarios in a controlled environment, reducing the possibility of injury to officers and citizens, and potentially reducing city exposure to liability or litigation. Clark Staten, Executive Director of Emergency Response and Research Institute (ERRI), stated there would be a great benefit to our armed forces and civilian emergency response to build a closer cooperative working relationship.<sup>22</sup>

## Training Cost

Small law enforcement organizations continually work with budget restraints and must plan in advance for equipment purchases. A potential means of making this training available to smaller organizations would be the development of regional training locations.

Research indicates that VR simulators reduce implementation of training time by 30 percent. In addition, this would reduce the amount of overtime needed to replace the officer who is at training. Other cost-saving considerations include:

1. Negative publicity due to a mishandled crisis situation.
2. The impact of citizens and police officers hurt or killed because of poor decisions.
3. Poor outcomes could result in budget reductions and organizational shake-ups.<sup>23</sup>

Applying technological advancements as a training tool could reduce our liability by better preparing law enforcement officers.

## Equipment Costs

Virtual reality systems are intensive and complex computer sources. In order to create photographic realism, the computer must be capable of generating an image comprised of 800 million polygons per second. High-end systems capable of producing 2 million polygons/second cost several thousand of dollars. A Head Mounted Display (HMD) costs 10,000 to 15,000 dollars, depending on the complexity of the head mount.<sup>25</sup> Other hardware costs depend

on the complexity of the individual system, ranging anywhere from 100,000 to 250,000 dollars. Market projects for the VRaptor indicate that in the first three years, over 550 units could be sold at 150 thousand dollars per unit. Target markets will be federal agencies, military, state and local police, prisons, and exposure to the international market.<sup>24</sup>

### Potential Funding Sources

There are several possible sources for virtual reality equipment funding. Federal grants and sponsorships from interested private sector industries are two potential sources. Insurance companies interested in reducing potential payouts may choose to fund VR programs. Military services that use VR training may form partnerships with local law enforcement agencies so they can experience VR training.

### Side Effects

Virtual reality technology is in its infancy and the amount of data regarding side effects is limited. Both physical and psychological effects have been identified. Between 10 and 60 percent of individuals who use VR systems experience cybersickness. Symptoms include headache, blurred vision, dizziness, and mild to severe nausea. Cybersickness may be the result of confused and conflicting sensory inputs.<sup>25</sup> Psychological effects have been described as sopite syndrome. This occurs when the individual has been exposed to the VR environment for an extended period of time. Symptoms include chronic fatigue, lack of initiative, drowsiness, lethargy, apathy, and irritability.<sup>26</sup> Another possible psychological reaction an individual could

experience is anxiety from wearing VR helmets and feeling claustrophobic.<sup>27</sup>

Officer training utilizing VR can reduce human and material loss during critical events. Officers with infrequent exposure to these situations can rehearse and practice appropriate responses in a safe but effective setting. An additional benefit to VR training is improved citizen relations from fewer judgmental errors by officers, resulting in injuries or loss of life.

## Chapter V

### Conclusions

At one time, computer technology was an event. Now it is a trend. Computer technology will continue to become a greater part of our organizational operations and training. Leaders of our profession need to continue to look toward the possible events within technological advancements to make informed decisions. Technological advancements in the field of virtual reality will be a beneficial training and planning tool for future events that have not yet occurred, for example, by taking a panoramic view of issues around the world such as bio-chemical warfare. The question should be formulating: It is not if this event will occur, but rather when?

The purpose of law enforcement is to protect the well-being of society. Leaders of law enforcement and government representatives need to formulate a strategic plan outlining the potential events that are likely to affect the ability to protect society. Virtual reality technology is already utilized by our armed forces.

Money available to train law enforcement personnel is limited. Possible solutions to budgetary constraints for both small and large law enforcement agencies are as follows:

1. Government officials allocate a percentage of the military's training budget to assist law enforcement. By use of virtual reality technology, cross-training between the two entities involving responses to incidents such as bio-chemical contamination can occur.

2. Implementation of virtual reality regional training sites. These sites would enable personnel of small law enforcement agencies to receive VR training. Part of the stakeholders included in the educational process of virtual reality would be government officials. If VR training is determined to be of value, then additional funding could be forwarded to POST to meet VR training needs.
3. An insurance company that insures groups of small cities and police agencies funds a pilot project. The project is an attempt to better train law enforcement personnel so there is a reduction in lawsuits.

The implementation plan should include law enforcement organizations such as the California Police Officers Association and the technology committee. This committee would serve as a point of coordination and would work with stakeholders to identify potential issues that could slow the implementation of VR training. Development of virtual reality exercises specific to the training needs of law enforcement would enhance the likelihood of critical situations being handled appropriately. By implementing this type of training by the year 2005 individuals who are currently involved in the profession would have a training tool that will provide a training environment that is verifiable and realistic to the situational dynamics often faced by police officers. For those individuals who will be entering the law enforcement workforce in the year 2005, they potentially will benefit by experiencing virtual reality during academy training. This will enhance their ability to correctly respond to potentially dangerous situations without the

formation of bad habits. One concern law enforcement recruiters have is that those individuals currently being recruited have little life experience and may have difficulty responding to hostile situations. Virtual reality will afford academy trainees an opportunity to experience such training in a protected environment.

Implementation of virtual reality training at regional training locations will enable police officers representing small and large law enforcement agencies to experience this educational process. This will also assist agencies located in remote areas of the state.

The future potential of this technology as a training tool is limited only by the imagination. Advancements in the field of virtual reality will enhance educational opportunities for law enforcement personnel so the profession can keep pace with its ever-changing response to society demands.

Appendix A  
List of Potential Trends  
Identified by the NGT panel

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- |     |  |     |   |
|-----|--|-----|---|
| 1.  | Recruitment of entry level officers  | 33. | Teaching and reinforcement of proper police actions/decisions |
| 2.  | Public educational resources (funding, staffing, equipment)                      | 34. | Rights of individuals/society                                 |
| 3.  | Development of less than lethal weapons  | 35. | Juvenile crime changes  |
| 4.  | Budget   | 36. | Human interpersonal communication (less human interaction)    |
| 5.  | Liability litigation   | 37. | Population density  |
| 6.  | Availability of information on how to commit crimes                              | 38. | Funding to local agencies                                     |
| 7.  | Types of activities / entertainment (how are people spending time)               | 39. | Telecommuting   |
| 8.  | Information overload (too much to comprehend)                                    | 40. | Changes in work time  |
| 9.  | Display of wealth (techs vs. non-techs)  | 41. | Latch-key children  |
| 10. | State/national economics   | 42. | Economic base of individual towns, rural cities               |
| 11. | Cost of travel   | 43. | Intelligence gathering (changes in level of secrets)          |
| 12. | Urban sprawl   | 44. | Shift from service to information based economy               |
| 13. | Public expectations of law enforcement   | 45. | User acceptance of technology                                 |
| 14. | Coordination of VR efforts with other agencies (federal, state, county, private) | 46. | Encryption  |
| 15. | Specialization of police functions   | 47. | Hate groups   |
| 16. | Band with changes  | 48. | Goals of policing (goals of community education)              |
| 17. | Crime rate changes   | 49. | Population mobility   |
| 18. | E-commerce   | 50. | Availability of computer power                                |
| 19. | Availability of real time information  | 51. | Increase in work comp claims                                  |
| 20. | Focus on disconnected youth  | 52. | Environmental planning  |
| 21. | Education level  | 53. | Contacts with outsiders                                       |
| 22. | Global economy   | 54. | Objectives of basic training                                  |
| 23. | Diversity  | 55. | Environmental planning  |
| 24. | Training mandates  | 56. | Staying at home   |
| 25. | Militias in rural areas  | 57. | Methods of addressing crime                                   |
| 26. | Availability of funds for training   | 58. | Changes in virtual reality technology                         |
| 27. | Labeling "Special Education"   | 59. | Public understanding of law enforcement tactics               |
| 28. | Trust government   | 60. | New crimes  |
| 29. | Accountability of police behavior  | 61. | Training relevancy to law enforcement                         |
| 30. | Global conceivability  | 62. | International terrorism                                       |
| 31. | Cost of VR technology continues to escalate                                      | 63. | Training standards  |
| 32. | Speed of technology  |     |   |
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Appendix B  
List of Potential Events  
Identified by the NGT Panel

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|--|---|
| <ol style="list-style-type: none"> <li>1. Movie industry generates interest in computer error</li> <li>2. National lab develops affordable virtual reality for law enforcement</li> <li>3. Adverse court ruling forces VR training</li> <li>4. Significant law enforcement incident that reflects lack of training</li> <li>5. Airborne microorganisms that eat silicon wafers</li> <li>6. Law enforcement officers are disarmed</li> <li>7. Software appears</li> <li>8. Governor signs bill offering VR training</li> <li>9. Travel reimbursements from POST are terminated</li> <li>10. Smart weapons technology covered by CNN</li> <li>11. Significant negative economic change for United States (depression)</li> <li>12. Unexpected consequences of VR (side effects on humans)</li> <li>13. Police officers in small law enforcement agencies demand VR training</li> <li>14. Cloning a human being</li> <li>15. Development of on-line VR training</li> <li>16. Governor signs bill to offer VR training statewide</li> <li>17. Commercial applications are developed</li> <li>18. Change in Chief of Police</li> <li>19. Economic based revolt</li> <li>20. Development of 100% effective non-lethal, non-contact restraining device</li> <li>21. Federal government develops VR training</li> <li>22. Police staffing is reduced by 25%</li> </ol> | <ol style="list-style-type: none"> <li>23. Increase public demand for realism causes company to develop VR product</li> <li>24. Creation of device that allows VR to interact directly with brain</li> <li>25. High profile person makes VR a priority (open source)</li> <li>26. Virtual reality is advertised on TV shows involving law enforcement</li> <li>27. Act of terrorism occurs in rural area</li> <li>28. Game start-up company creates easy-to-use VR</li> <li>29. Technology prices stay high</li> <li>30. Consolidation of small police agencies with county</li> <li>31. Wireless high band puts every police department in touch with national/state VR lab</li> <li>32. Private sector develops secure communications for police department</li> <li>33. X-rated VR is developed</li> <li>34. World war</li> <li>35. Display break-through</li> <li>36. On-site populations at colleges drop because of distance learning</li> <li>37. High rates of officers are killed in training exercise</li> <li>38. Public outcry for better training</li> <li>39. Microsoft creates comprehensive training program (replacing all training: basic, CPT, etc.)</li> <li>40. Single useful Virtual Reality Modeling Language (VRML) over the Internet</li> <li>41. Colonization of another planet</li> <li>42. Cost of training experience exceeds VR development</li> <li>43. Out-of-control media event</li> <li>44. New crime</li> <li>45. Domestic terrorist event</li> </ol> |
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## Endnotes

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