TIGER VISION

By
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Printed on Recycled Paper

TIGER VISION

MARKET ASSESSMENT

Prepared for

The Office of Law Enforcement
Technology Commercialization
U.S. Department of Justice

Under
OLETC P.O. No. 06522

by

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Submitted: February 20, 1998

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EXECUTIVE SUMMARY

Product Overview

Though most accurately described as an "object identification system for use in varying light conditions," Tiger Vision is, in fact, a night-vision device for use in low- and no-light conditions, primarily in law enforcement and related applications. Tiger Vision is neither a thermal-imaging system nor a light-intensification system, but instead, captures and processes near-infrared light reflected off observed objects.

Embodied in a pistol-grip mounted housing measuring 4"x4"x9", the unit weighs five pounds, though further engineering will reduce this weight by half. It is designed to be operated in or immediately adjacent to a patrol car, which also serves as the unit's power source. The unit is held away from the user's body and pointed in the direction of the objects to be observed. Most effective at 50 to 100 yards, the resulting image is displayed on a monitor at the back of the housing for easy viewing by the user.

Tiger Vision offers many distinct features, some attributable to its unique technology and some to its design. Among the most notable features are an exceptionally high image quality of a full 40^{o} field of view; full peripheral vision of the user; and application in *any* light conditions, including total darkness and exposure to sudden bright light. In addition, Tiger Vision incorporates range-finding technology, which allows the user to determine the distance and size of the subject being observed and to quickly detect sudden movement by the subject.

Primary Customer Base

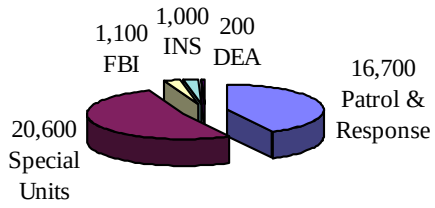
- police and sheriff departments, especially patrol units and warrant officers
- SWAT teams – state, federal, and local
- law enforcement training academies
- U.S. Border Patrol
- corrections (local, state, and federal)
- investigative units (incl. surveillance and undercover operations) within local law enforcement agencies
- military police
- game wardens
- law enforcement task forces

Secondary Customer Base (requiring longer development period)

- U.S. Federal Bureau of Investigation
- U.S. Drug Enforcement Administration
- U.S. Coast Guard
- search & rescue
- drug enforcement units – local, state, federal
- private security organizations
- private investigators
- commercial/industrial security personnel
- air support of law enforcement activities

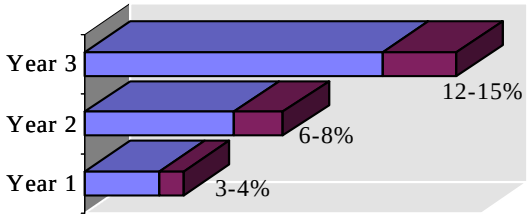
Total Market Potential

Estimated Potential for Night Vision Devices = 39,600 Units



It is estimated that today's total demand for night vision devices by the domestic law enforcement community is 39,600 units, spread among local, state, and federal organizations. This figure was derived by applying interview-generated estimates to various law enforcement populations gathered from secondary resource publications.

3-Year Projected Market Capture for Tiger Vision



Tiger Vision is expected to capture 3%-4% (1,200 to 1,600 units) of the market during its first year following introduction. Year 2's projection is for 6%-8% market share (2,400 to 3,200 units), escalating to 12%-15% (4,800 to 6,000 units) in Year 3. At the recommended price point of $500/unit, these projections represent sales of $.6-$.8 million in Year 1, $1.2-$1.6 million in Year 2, and $2.4-$3.0 million in Year 3. These estimates assume someone *other* than a dominant industry leader produces, markets, and distributes Tiger Vision. In the event such a company does license Tiger Vision, the above estimates would represent minimum penetration levels.

Competition

- ➔ Night-vision industry comprises two major technology areas – image intensifiers and thermal imaging – served by 15 to 30 companies. Tiger Vision may complement thermal-imaging devices, but will seldom overlap markets because of major cost and applications differences. Thus, the major competitors will be image-intensification devices.
- ➔ Image intensification devices are typically monoculars, binoculars, and scopes, all claiming many similar features. Prices range from $250 for repackaged Russian/Eastern European-based devices to more than $6,500, distinguished primarily by use of Generation I, II, or III technology.
- ➔ Tiger Vision offers virtually all of the same important features, plus full peripheral vision, a clearer image, built-in video capabilities, and a substantially lower price.
- ➔ Only one company, Optical Electronics, Inc. (OEI), Tucson, AZ, markets a device substantially similar to Tiger Vision. OEI's device is much more costly, however, and may infringe on Tiger Vision's patent. This issue of possible patent infringement should be explored and resolved so as not to interfere with subsequent licensing negotiations.

Market Barriers

- Superior clarity, ruggedness, and ease of operation of all new entrants in this market must be demonstrated frequently and consistently.
- Primary customer base operates in an environment notorious for low budgets and high bureaucracy.
- Law enforcement market is fragmented ….. geographically and organizationally.
- Customer base is easily confused by the broad array of night-vision devices.
- Many law enforcement agencies are still using outdated military surplus night-vision devices.

Recommended Pricing & Marketing Strategies

- Target a price point of $500 to no more than $750 per unit …. High enough to be differentiated from repackaged Russian devices, but low enough to compete well against other devices and still be attractive to customer base. Resistance and competition will increase as the price point approaches $1,000.
- Pursue five primary marketing strategies:
  1. promote Tiger Vision to the hundreds of training academies presently operating;
  2. advertise in selected trade journals;
  3. establish and maintain a presence at the industry's major trade shows;
  4. implement regular demonstration programs with the largest law enforcement agencies; and
  5. if the price point eventually approaches $1,000 per unit and presents hurdles for interested customers, explore implementing a leasing program similar to those offered by ITT and Litton.

INTRODUCTION

Over the last 50 years, continual innovation in night-vision technology has helped elevate military, law enforcement, and similar security-related activities to a higher plane of effectiveness. At the same time, boating, outdoor recreation, search-and-rescue, and other non-security applications have emerged, and industry has responded with a wide variety of applicable night-vision devices.

The first night-vision equipment was developed by the U.S. military in the late 1940s and required an external infrared light source to operate. In the 1960s, improvements in the image-intensifier tube made it possible to use starlight as the only available light source. Since then, night-vision technology has progressed through first-, second-, and third-generation devices based on the design of the image intensifier.

Historically, the performance of night-vision devices has increased dramatically with successive generations of technology, but so, too, has the price. High-end thermal-imaging equipment can substantiate impressive claims regarding features and performance, but at a cost of tens of thousands of dollars, only the military, a few federal agencies, and foreign governments can afford these top-of-the-line units.

Other state-of-the-art technology involving image-intensification technology has so far filled much of the large price void underneath thermal-imaging equipment, but the best image-intensification units are still more costly than most local and state law enforcement agencies can afford. In addition, as well as these units perform, they lack certain features which would make them even more attractive to many potential users in the law enforcement and corrections industry.

The subject innovation, Tiger Vision, was developed in response to both the high cost and limited features of existing night-vision equipment. Created by Mark Jones, San Antonio, Texas, after years as a law-enforcement officer, Tiger Vision falls into neither of the established night-vision technology camps, but instead, represents a unique approach to night vision. The result is a reasonably priced, high-performance unit with features found on no other night-vision device on the market today.

I. TECHNOLOGY OVERVIEW

Tiger Vision is embodied in a pistol-grip mounted housing measuring 4”x4”x9” and currently weighing about five pounds, though further engineering will reduce this weight by half. The unit is designed to be operated in or immediately adjacent to a patrol car, which also serves as the unit’s power source. The unit is held away from the user’s body and pointed in the direction of the objects to be observed. Most effective at 50 to 100 yards, the resulting image is displayed on a monitor at the back of the housing for easy viewing by the user.

According to its patent application, Tiger Vision is more accurately described as an “object identification system for use in varying light conditions.” In fact, however, Tiger Vision was

developed for use as a night-vision device in low- and no-light conditions and primarily in law enforcement and related applications.

The two dominant types of night-vision equipment today are (1) thermal-imaging systems and (2) light-intensification systems. Thermal-imaging technology operates by sensing and then processing the heat energy emitted by objects under observation. Light-intensification systems, on the other hand, operate by magnifying a very low level of light until it is visible to the naked eye.

Tiger Vision belongs to neither of these camps. Instead, the Tiger Vision technology fans non-coherent, broad-band light (near-infrared) out onto the entire field of view and then receives that light, together with any available ambient light, as it is reflected off the object(s) under observation. The reflected light is captured by an electro-optic device in the unit's housing and converted into an electronic signal. This signal is then translated into an image, which appears on the black-and-white display monitor. An important feature of Tiger Vision is that this signal can also be captured by a storage device – e.g., video; diskette – for later viewing.

Tiger Vision offers many distinct features, some attributable to its unique technology and some to its design. Among the most notable features are an exceptionally high image quality of a full 40^{o} field of view; full peripheral vision of the user; and application in *any* light conditions, including total darkness and exposure to sudden bright light. In addition, Tiger Vision incorporates range-finding technology, which allows the user to determine the distance and size of the subject being observed and to quickly detect sudden movement by the subject.

II. DESCRIPTION OF CUSTOMER BASE

The law enforcement community comprises the primary customer base for Tiger Vision. The inventor, Mark Jones, describes his ideal customer base as law enforcement officers, private investigators, warrant officers, military police, and security officers – especially those who operate from a vehicle or have need for full peripheral vision.

Night-vision devices (NVDs) are designed to help officers perform during night-time hours with greater efficiency and safety. They allow officers to discreetly observe suspicious behavior and conduct routine surveillance in near-total darkness. NVDs are also useful in emergency-response situations involving hostages, barricades, disaster relief, and search and rescue. Within the law enforcement agency, these activities are covered in special units involving tactical, narcotics and investigative assignments.

The primary customer base for Tiger Vision includes the following:

- police departments (especially patrol units) & warrant officers
- sheriff departments
- SWAT teams and their command centers – local, state, and federal
- investigative/detective units (including surveillance and undercover operations) within local law enforcement agencies

- task forces (e.g., gangs; juvenile offenders)
- law enforcement training academies
- corrections (local, state, and federal)
- U.S. Border Patrol
- military police
- game wardens

A secondary customer base, requiring a greater lead time to develop, includes:

- U.S. Federal Bureau of Investigation
- U.S. Drug Enforcement Administration
- commercial/industrial security personnel
- law enforcement air support operations
- narcotics/drug enforcement units – local, state, and federal
- U.S. Coast Guard
- private security organizations
- private investigators
- search & rescue units

Though not addressed in this report, additional markets include many non-law enforcement applications, such as boating, outdoor recreation, wildlife management, and personal security.

III. SIZE OF MARKET

The data collected for this market study indicate there is sizable potential for Tiger Vision.

According to the **Bureau of Justice Statistics, 1993 Law Enforcement Management and Administrative Statistics**, the local and state law enforcement community comprises 17,120 publicly funded state and local law enforcement agencies with a combined 622,913 full-time sworn officers. Approximately two thirds of this group (~417,351 officers) are involved in general law enforcement activity, while the other one third (~205,561 officers) are engaged in tactical, narcotics, and investigative activities. In addition, 40 percent of all agencies support special-mission teams, and there are approximately 60,000 SWAT officers throughout the country.

Within the federal law enforcement community, there are:

3,776 Special Agents, U.S. Drug Enforcement Administration
11,321 Special Agents, U.S. Federal Bureau of Investigation, and
10,000 law enforcement personnel (est'd), U.S. Immigration and Naturalization

Interviews with local, state, and federal law enforcement personnel were used to arrive at estimates of the number of NVDs applicable to the above populations. The results are as follow:

- For general police and patrol duties ….. four percent of the total population (i.e., two NVDs are sufficient for a police department of 55 officers) ***∴ ~16,700 NVDs should serve the 417,351 officers engaged in general law enforcement activity.***

- For narcotics, surveillance, or investigative teams ….. 10 percent of the population (i.e., three NVDs will adequately supply a team of 30 members. Exceptions include surveillance and tactical teams, where two to three devices might be supplied to subunits of 10 persons)
  ∴ ~20,600 NVDs should serve the 205,561 officers engaged in tactical, narcotics, and investigative activities.

- For federal FBI and INS personnel ….. 10 percent of the population ***∴ ~1,100 NVDs should serve the 11,321 FBI agents and ~1,000 should serve the INS agents.***

- For federal DEA personnel ….. An interviewee estimated ***~190 night-vision devices as an appropriate figure for DEA agents.***

Overall, the potential market for night-vision devices within the domestic law enforcement community is estimated to be 39,600 units.

An important factor relating to this 39,600-unit estimate is that much of the existing NVD inventory comprises free or very low-cost surplus military equipment. This surplus is beginning to shrink and is not being replaced by the military. Furthermore, as the surplus equipment becomes increasingly obsolete, it is being replaced with commercially produced night-vision equipment.

While data is sketchy, ITT Night Vision, the dominant market leader with an estimated 70 to 75 percent of the military, law enforcement, and selected consumer markets, has been quoted as having sales of ~$10 million annually to the law enforcement segment alone. ITT's recently announced expansion to double capacity is a good sign that law enforcement markets are growing. Taken together, these data suggest that the market potential for Tiger Vision is promising.

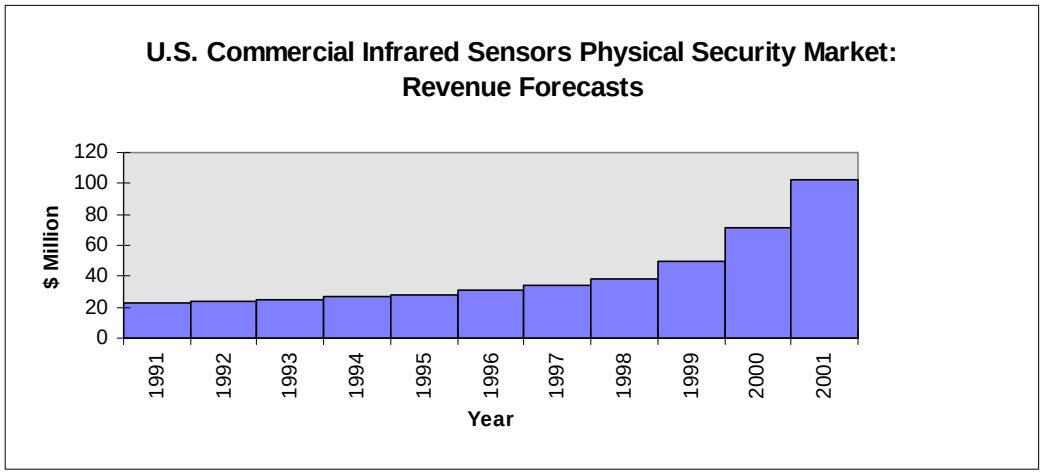
IV. MARKET FORECAST AND ANTICIPATED SHARE

Overall Market Outlook

A DIALOG on-line literature search identified a 1995 market forecast produced by Frost & Sullivan, one of the leading suppliers of proprietary market data. The main report, titled **U.S. Commercial and Military Infrared System Markets**, forecasts the revenues and growth rates for the commercial physical-security market. "Physical security," as defined by Frost & Sullivan, includes home and building security, **border patrol and other types of security such as the U.S. Immigration and Naturalization Service.**

The report specifically discusses night-vision equipment and states, "purchases from commercial vendors are limited....because of the high cost of equipment and the administrative hurdles it (INS) must go through to procure expensive high-technology equipment." The report goes on to say, "One of the main hindrances to the growth of this market has been the prices of the systems. If the market is to expand significantly, the prices of systems will have to decline enough for commercial end-users to justify the expense." Pricing, discussed in greater detail in the final section of this report, is a major competitive advantage of Tiger Vision.

The Frost & Sullivan forecast supports a positive sales outlook for infrared systems. In 1991, revenues were reported to be $23.2 million, increasing to $26.4 million in 1994 at an annual growth rate of 4.7 percent. Growth rates reached the double digits in 1996 at 10.4 percent. A healthy 21.3 percent compounded annual growth rate is calculated for the forecast period of 1994-2001. By the year 2001, sales revenues are projected to reach $102 million. (See figure below.) Falling prices and improved product performance are the main reasons for increasing product demand and sales revenues.

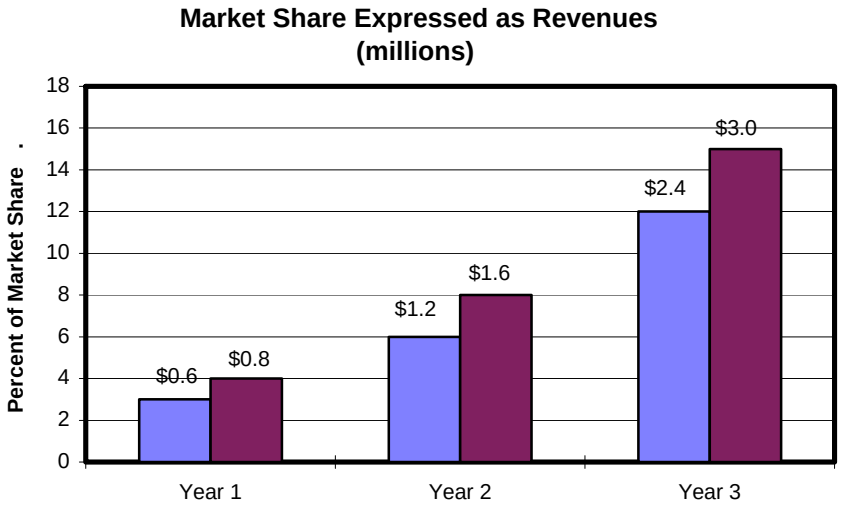


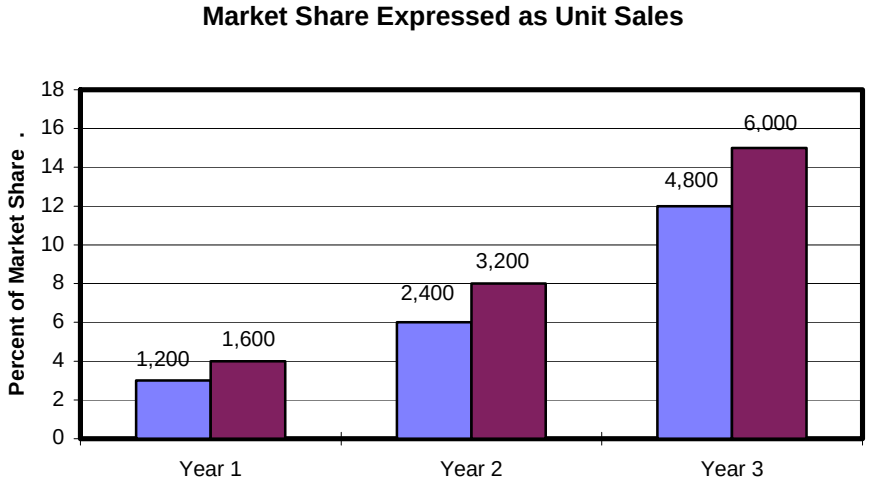
Source: Frost & Sullivan, **U.S. Commercial and Military Infrared System Markets,** Figure 3.21, April 1995.

Tiger Vision's Anticipated Market Share

As a new, advanced-technology product, Tiger Vision will need to be thoroughly field tested before customers will commit to purchases, and its market penetration will be slower in the first two years after introduction. Ranges for Tiger Vision's market penetration have been assigned, as market-share estimation is an inexact science.

In year one following Tiger Vision's introduction, market penetration is estimated to be **three to four percent, or 1,200 to 1,600 units**. At the targeted $500 price point, this penetration represents **sales of $600,000 to $800,000**. In year two, Tiger Vision's share should double to **six to eight percent (2,400 to 3,200 units) for sales of $1.2 to $1.6 million**. By year three, penetration should reach **12 to 15 percent (4,800 to 6,000 units) for sales of $2.4 to $3.0 million**. These projections are illustrated in the following charts:





The above market-share estimates assume the following:

- ➔ total market for NVDs = ~40,000 units
- ➔ Tiger Vision is **not** marketed and distributed by ITT or one of the other industry leaders;
- ➔ even after Tiger Vision's initial sales, continued field testing and demonstration will be necessary and will create a time lag in securing additional orders; and
- ➔ initial orders will involve lower quantities in years one and two due to the newness of the Tiger Vision name and the time required to establish a reputation.

While these forecasts were made separately from those previously determined by another independent firm, they do agree with the overall timetable for the first significant product ramp-up occurring in the third to fourth year after market introduction. Anticipated market share projections are based on information gleaned from the Tiger Vision interviews, together with what is already known about new-product introduction and market-penetration rates.

It is noteworthy that the above market-penetration estimates would be on the conservative side if one of the industry leaders, with their established sales and distribution networks, were to pick up Tiger Vision.

V. COMPETITION

Tiger Vision should be expected to operate in a strongly competitive market, but one which also offers opportunities.

The law enforcement/corrections and commercial/industrial security markets are served by 10 to as many as 20-30 companies producing and/or marketing various night-vision products. At the top of this list are the industry titans -- e.g., ITT and Litton with image intensifiers and Raytheon with thermal imaging. Other companies – e.g., Night Vision Equipment Company, Emmaus, PA; B.E. Meyers & Company, Redmond, WA – produce and sell their own products while also serving as a distributor for another producer's line. In this case, both Night Vision Equipment Company and B.E. Meyers distribute Litton's product line. At the lower end are a number of quite small companies – e.g., Alpha Design; Optical Electronics, Inc. – which either sell Russian- and Eastern European-based devices or have just recently entered the market with their own technologies.

<u>Thermal Imaging Technology</u>

Recalling that the night-vision industry is segregated into two major technology areas – image intensifiers and thermal imaging – *it is safe to assume* ***Tiger Vision will seldom compete head-to-head with thermal-imaging technologies.*** Cost is the primary differentiating factor. A secondary factor is the difficulty in understanding and properly using thermal-imaging products.

Raytheon, by far the largest thermal-imaging technology firm, sells its Nightsight product for around $6,500. This figure is at the low end of the thermal-imaging price range, as other systems run $10,000 to $40,000 and higher. Raytheon developed Nightsight specifically for the law enforcement/corrections industry. In comparison, Inframetrics, another well-established thermal imaging firm, asks $28,500 for a hand-held night-vision unit which the company claims is easily adaptable to law enforcement/corrections activities.

At these levels, only the largest law enforcement agencies and the federal government are able to purchase thermal-imaging systems with regularity. Inframetrics' Andrew Owen confirmed this, saying his company's law enforcement sales have involved only the federal government.

Overall, Owen stated flatly that ***local and state law enforcement and corrections agencies represent an extremely limited market for thermal imaging night-vision systems.*** He added that thermal-imaging technology will probably never come down enough in price to compete in the $1,000-$2,000 and under market.

Image Intensifier (I^2) Technology

The I^2 arena is where the Tiger Vision will meet its stiffest competitors. Competition will emerge on several different fronts, including product cost and capabilities.

A strongly related factor is the market's seeming inability to differentiate and choose wisely from among the many available night-vision products. Virtually all interviewees agreed that potential customers are easily confused by the technical differences among night-vision devices. This factor will weigh against the subject invention until its performance can be demonstrated.

The following sections identify and discuss Tiger Vision's most likely competitors.

ITT Night Vision

At the top of the I^2 industry is ITT Night Vision, with a market share estimated to be at least 70 percent. With more than 50 years' experience, ITT is the recognized leader of night-vision devices in the U.S. and Allied military markets, as well as the law enforcement and selected consumer markets. ITT claims it produces more intensifier tubes than all its competitors – worldwide – combined. This claim is supported by comments from various non-ITT contacts and is reflected in ITT's recently announced $20 million expansion to double production levels by 1999.

ITT's first commercial night-vision device was the Mariner, introduced in 1993 specifically targeting the boating market. The Night Enforcer followed in February 1994, developed for law enforcement and security applications. The Night Enforcer differs significantly from the Mariner in color only.

The Night Enforcer models 150/250 and 160/260 offer the following features:

- monocular; F1.4 optics
- 40^0 field of view
- battery operated (2 AAAs to 6 volts)
- auto gain control with manual override
- 16 to 26 ounces
- auto focus and auto shutoff
- video capable with modifications & added equipment

- auto brightness prevents "white out"; microchannel plate prevents "blooming"
- retail prices range from $995-$2495 retail, depending on model:
  - models 150/250 use Gen. II technology, up to 30,000x moonlight/starlight
  - models 160/260 use Gen. III technology, 50,000x moonlight/starlight

Like the Night Enforcer, Tiger Vision offers a 40^0 field of view – an important distinguishing feature of today's cutting-edge night-vision technology – as well as video capability and the ability to prevent "whiteout" and "blooming." Also, Tiger Vision is *not* monocular or binocular, but instead, offers the user full peripheral vision, an important difference according to interviews. Another competitive advantage is cost. Once in production, Tiger Vision's estimated retail price is $500 to $750, roughly half that of the Night Enforcer.

Still another advantage is image clarity. Tiger Vision claims 450 lines of resolution, similar to that on a black and white television. ITT's Gary Palmer, the engineer responsible for designing all 27 of ITT's night-vision products, claims to have achieved an equal level of clarity in his lab. To date, however, none of ITT's commercial products on the market can match Tiger Vision's clarity, as evidenced by a recent side-by-side demonstration of ITT's products and Tiger Vision.

On the downside, however, Tiger Vision is not currently battery operated, though it can easily be adapted for use with batteries. In addition, Tiger Vision's current prototype unit is several times heavier than the Night Enforcer. This latter point will be addressed through continued engineering improvements, which will reduce the weight of the finished production prototype to no more than 2.5 pounds.

Litton Industries

Litton, and specifically its Electro-Optical Systems Division, is the other major player in the market for night-vision devices. No specific market-share figures were available, but with ITT owning at least 70 percent of the market, Litton holds the bulk of the remainder, with a strong presence in international sales. Dividing the bulk of the market between ITT and Litton is justified by the fact that Litton and ITT are the world's only two producers of high-quality Generation II and III image-intensifier tubes.

Litton boasts a much wider array of products than ITT. Many of Litton's products still contain Generation II technology, which opens international markets. ITT, on the other hand, has relied almost exclusively on Generation III technology, which severely restricts international sales due to export prohibitions.

Litton's Modular Night Vision Device (M942/M944), Modular Night Vision System (M911A), and Night Vision Monoculars (M982/M983) are the primary products sold to the law enforcement/corrections and security markets:

- ➔ All are light-weight (700-3,000 grams), monocular devices designed for surveillance, observation, and photography.
- ➔ All are field-adaptable for use with reflex and video cameras and CCTV systems.
- ➔ The M942/M944 and M983 units contain Gen. III technology; the M911A and M982 employ Gen. II tubes.

Litton's retail prices are significantly higher than ITT's, ranging from the lower-end M982 unit at ~$3,200 to $6,500 and up for the M911A Night Vision System.

Unlike ITT, which uses a distribution network involving dozens of established dealers, Litton employs only three or four distributors, including Night Vision Equipment Company, Emmaus, PA; Nightline, Inc., Miami, FL; and B.E. Meyers & Company, Inc., Redmond, WA. Competition between Litton and ITT is strong which, according to a Litton marketing rep, has driven margins down.

Litton does not produce a device similar in design, operation, or price to Tiger Vision, nor is there reported to be such a product under development.

Optical Electronics Incorporated (OEI)

Based in Tucson, AZ, OEI has entered the night-vision market in just the last year, drawing heavily on the company's long experience in video imaging. OEI's main night-vision product is its Model 305 Hand-Held Nightviewing System, which includes several iterations featuring enhanced benefits. Suzanne Gerdes, OEI's president, claims the Model 305 System is being well received by the law enforcement market, but declined to provide specific sales figures.

The Model 305 (with its Model 405 and 505 iterations) is the closest night-vision device to Tiger Vision on the market today. All models in the series are 2.5-pound, hand-held devices with a pistol-grip handle and a 2-inch or 4-inch monitor. The units are powered by a 12-volt battery pack or by plugging into a vehicle's lighter. Using an infrared (IR) illuminator, the units illuminate over 200 feet and contain an IR-sensitive camera with a 16mm lens. According to the company's literature, this set-up provides a television-quality image on the monitor. All models in the series are reportedly capable of video recording the image being viewed.

Ms. Gerdes further explained that OEI's system is neither thermal imaging nor I^2, but rather, is an active system which emits and then receives IR light as it is reflected off viewed objects. She revealed that the Model 305 retails at $2,200.

Tiger Vision's developer, Mark Jones, is very aware of OEI's equipment and agrees the units are similar to Tiger Vision in many respects. However, he also maintains that ***OEI's products infringe on the Tiger Vision patent***, and at an appropriate time, he will approach OEI with a notification of this infringement.

Low-End Russian Night-Vision Devices

On the low end of the competitive scale are the many night-vision devices containing Russian intensifier tubes. Russian tubes, which are generally considered to still be at the Generation I level, began entering this country in the early 1990s, following the fall of the Berlin Wall. MoonLight, U.S. Calvary, and Alpha Design are just three companies repackaging this technology, which is often sold by downplaying the Russian origin of the intensifier tubes and focusing on the fact that the finished product is "Made in America."

Though these Russian-technology devices fare poorly in a head-to-head comparison to Tiger Vision, they are important to monitor for two reasons – (1) cost and (2) the market's general unfamiliarity with night-vision devices. Virtually all of the individuals interviewed for this market assessment confirmed that buyers – including those in the law enforcement and corrections and security markets – are by and large unfamiliar with night-vision technology and confused by the wide array of product offerings. This confusion leads many buyers to the low-priced end of the product array, where the Russian-technology devices are available beginning at $250. Most of these early-generation, minimal-featured devices are sold to the everyday consumer market, but with such a low price, they will attract other commercial buyers as well.

VI. PRODUCT COMPARISON

Tiger Vision is expected to compete well in certain feature areas, including uniqueness of design, image clarity, ease of use, and expected cost. In other areas, however, Tiger Vision will be challenged to prove its distinctiveness.

<u>Relative to OEI's Model 305</u>

Tiger Vision appears to be one of only two hand-held, night-vision devices with a monitor for viewing the image. OEI's Model 305 device is the other. Drawing from both product literature and interviews, the two devices appear to be quite similar in most respects involving usage, operation, and performance.

Tiger Vision's Mark Jones is familiar with OEI's products and maintains the Model 305 is a simple modular device produced by connecting several key off-the-shelf components, and thus,

is incapable of meeting Tiger Vision's performance standards. This conclusion may be impossible to support objectively without a head-to-head test.

The more important distinction is cost. OEI retails the Model 305 beginning at $2,200, while Tiger Vision is expected to retail between $500 and $750, depending on production levels. A second critical factor is that the Model 305 reportedly infringes on Mark Jones' patent for Tiger Vision. If an infringement notice is issued and ultimately upheld, OEI's line of night-vision devices will cease to be a player in the market. Alternately, if an infringement notice is not upheld, Tiger Vision will have a competitive price advantage, but will lose ground initially because the OEI equipment is already on the market.

Relative to ITT's Product Lines

ITT's night-vision devices for the law enforcement/corrections and security markets are monocular and binocular units. ITT does not produce a hand-held device substantially similar to Tiger Vision. Additionally, Tiger Vision offers a superior image clarity as well as a superior price.

Gary Palmer, who has engineered ITT's night-vision devices and is familiar with Tiger Vision, revealed that he is working on a hand-held unit which will be held one foot from the user's face. He also claims not to be particularly impressed with Tiger Vision's image clarity, maintaining he has achieved similar clarity on devices in his lab. [Note: Palmer's comments should be received in the context that ITT has been approached to license Tiger Vision, and he may be intentionally downplaying Tiger Vision's capabilities prior to making a licensing decision. In addition, Palmer's familiarity with Tiger Vision stems only from previous discussions with Mark Jones. Palmer has neither seen nor used a Tiger Vision unit.]

Even though its products may not be able to surpass Tiger Vision in a head-to-head comparison, ITT's lengthy history with night-vision technology makes the company a formidable competitor. One interviewee, an ITT competitor, described ITT as the "Cadillac" of the industry, emphasizing ITT's quality by stating that buyers "get what they pay for." ITT is unquestionably the industry leader and possesses the resources, experience, and reputation to hold its own in the marketplace, even if its products are somewhat more expensive.

Relative to Litton's Product Line

Litton's product line is very similar to ITT's in terms of quality, but Litton has chosen to differentiate itself by developing and supporting a broader array of products and a different distribution network. This approach has helped Litton capture more of the international market as well as a good share of the domestic market for high-quality, though still not state-of-the-art, night-vision devices.

Litton, like ITT, does not produce a hand-held unit substantially similar to Tiger Vision. Litton's prices are noticeably higher than ITT's, and several magnitudes above Tiger Vision's price point.

Relative to the Low-End Russian-based Devices

Tiger Vision is superior to the many Russian-based devices in every aspect except price. Widely available at $250 and up, these devices are dominating the broad consumer markets involving leisure activities and applications …. markets for which Tiger Vision is not designed.

Competition will be stiffer in the low end of the law enforcement/corrections and security markets, where state and local law enforcement agencies are often prohibited from acquiring expensive equipment. In this market, Tiger Vision's clearly superior features and capabilities will sometimes lose out to the less expensive Russian-based devices, especially when there is no chance for the buyers to thoroughly research the options and see the units demonstrated.

Tiger Vision's overall strengths and challenges are summarized below:

Tiger Vision's Strengths

- ➔ Hand-held device which provides full peripheral vision and avoids eye adjustment period common to monoculars and binoculars.
- ➔ Unique rear monitor displays image.
- ➔ Image clarity equal to or well above any other night-vision device on the market.
- ➔ No distortion (i.e., "blooming" or "whiteout") caused by exposure to bright lights.
- ➔ 40^0 field of view, equal to the maximum available today.
- ➔ Range finder and motion detector assist in identifying the subject being viewed.
- ➔ Highly competitive price for the claimed quality and performance.
- ➔ Strong patent position to preclude look-alikes.

Tiger Vision's Challenges

- ➔ Video capabilities ….. Many other units also claim video input/output capabilities.
- ➔ Establishing value of Tiger Vision's advantages….. Tiger Vision's infrared-reflection technology fits into neither the I^2 nor the thermal imaging camp. Though this difference may interest technicians, the final user will be interested only in what value this different approach adds to the finished product's performance.
- ➔ Weight ….. Tiger Vision's present prototype weighs approximately five pounds. Other existing night-vision devices usually fall well under this weight, with ITT's as low as about 20 oz.
- ➔ Imaging capabilities in total darkness ….. Imaging in total darkness is not an issue in thermal imaging, because the technology "sees" heat, not light. With I^2 technology, even the best Generation III devices require *some* amount of light. In the absence of adequate light, infrared illuminators are employed to supplement the available light. At issue is whether Tiger Vision's total-darkness capabilities are substantially different than in other devices.
- ➔ Power supply ….. Tiger Vision is designed to be plugged into a vehicle's lighter and operated either inside or immediately adjacent to the vehicle.

VII. MARKET BARRIERS

Several key areas must be addressed before Tiger Vision is likely to achieve measurable market entry and penetration. While none of these areas are considered to be insurmountable, they are likely to impede commercial adoption if not addressed adequately.

1. ***Superior performance – especially in clarity, ruggedness, and ease of operation – must be achieved and then demonstrated consistently***. Without exception, law enforcement officers were drawn to Tiger Vision's attributes. However, each officer also wanted to see and use the equipment first-hand prior to purchase. Additionally, after cost, durability and ruggedness are close secondary criteria against which the Tiger Vision would be judged. To this end, the U.S. Drug Enforcement Administration requires all equipment be put through its testing and evaluation series, which can take several weeks, prior to any further consideration of procurement.

The field testing and demonstration process on Tiger Vision has begun, but will need to expand to other geographic regions. These activities will add considerable cost and time to the commercialization process. Opportunities to consolidate demonstration efforts are discussed further under Section VIII, Recommended Marketing Strategies.

2. ***Law enforcement agencies are notoriously budget conscious and bureaucratic***. Local law enforcement agencies, particularly in smaller communities, expressed the strongest concerns about their financial ability to purchase new equipment. Once convinced of Tiger Vision's merit, the procurement process can take as long as a year to be completed.

Other agencies can respond almost immediately to requests for small capital equipment purchases – and Tiger Vision's expected $500 to $750 price tag will usually fall within the acceptable range. Some agencies even permit supervisory officers to charge small equipment purchases on a credit card. In general, however, the local budgeting and procurement processes are highly regimented and can be expected to slow the sales of Tiger Vision, just as they slow the purchase of other night-vision equipment.

One notable exception is when drug forfeiture money is available. Expenditures from these funds must typically be tied into future narcotics control and prevention, but night-vision equipment clearly falls within this stipulation.

3. ***The law enforcement market is fragmented.*** With over 17,000 law enforcement agencies in the United States, excluding federal agencies, the market is geographically fragmented. Because it will be impossible to reach all members of this wide audience directly, establishing highly efficient sales and distribution networks is critical.

4. ***Tiger Vision's primary customer base is easily confused by the broad array of night-vision devices on the market today.*** Virtually all interviewees contacted for this study acknowledged that sales to state and local law enforcement prospects are made more difficult by the customer not understanding the technical differences among night-vision devices, even when those differences are critical in distinguishing one product from others. Without a better understanding of these differences, customers instead focus on features – e.g., image breadth and clarity, ruggedness, and cost. Tiger Vision should expect to benefit from this focus, but only if it can be demonstrated by the individuals who will be using it.

5. ***Many law enforcement agencies are still using older night-vision equipment discarded by the military.*** Over half of the law enforcement agencies interviewed said they are using military surplus night-vision equipment. A common justification was that, while the equipment is cumbersome, it was obtained at no cost. The supply of this equipment is said to be drying up, and what remains is being requisitioned by the larger police departments with full-time procurement personnel and expertise.

The impact of this surplus, no-cost alternative on Tiger Vision is to dampen demand for new equipment. However, once Tiger Vision is demonstrated to be far superior to the military surplus and is shown to be available at an affordable price, resistance to the newer product lines is expected to decline.

VIII. EXTERNAL CONSIDERATIONS

Tiger Vision should not expect to encounter any insurmountable legal or regulatory barriers. In reaching this conclusion, research explored the following two possibilities:

1. <u>the potential for legal restrictions regarding privacy issues:</u> According to Richard Whitlock, an attorney in the Oregon Attorney General Office who has studied how the courts have addressed the use of night vision in law enforcement, there has been no direction from either state or federal courts, other than several Circuit Court decisions approving the use of thermal-imaging applications. Most states have passed legislation restricting the use of certain "surveillance enhancements," but these devices typically refer to listening devices which intrude on peoples' privacy. Specifically with regard to night-vision devices, Whitlock maintains the key to avoiding trouble is to use them in such a way that privacy is not invaded.

2. <u>the potential for regulatory restrictions arising from the proposed export of Tiger Vision technology</u>: Unlicensed export of night-vision equipment is strictly prohibited by the U.S. Department of State, Office of Defense Trade Controls, and is a federal crime under Title 22, Foreign Relations, Subchapter M, International Traffic in Arms, Parts 121 through 130. These regulations govern the export of articles, services, and technical data identified on the U.S. Munitions List, among which are night-vision goggles, pocketscopes, and other similar equipment.

A licensing agent with the Office of Defense Trade Controls clarified that **all manufacturers** of night-vision equipment ***must*** register with either the State Department or the U.S. Department of Commerce, ***regardless of whether the products will be exported***. Manufacturers of all Generation II and III equipment, all other infrared equipment, and thermal-imaging night-vision equipment must register with the State Department, while producers of Generation I devices must work through the Commerce Department.

If there is uncertainty regarding the need to register, the manufacturer may seek a determination under the "Advisory Opinion" procedure. This procedure involves submitting a written request for an advisory opinion. The request must outline in detail the equipment or service, its intended usage, application, security classification (if any), and the country or countries of destination if the unit is to be exported. The appropriate mailing address and phone are listed below:

PM/DTC, SA-6, Room 200
Office of Defense Trade Controls
U.S. Department of State
Washington, DC 20522-0602
703/875-6644

IX. RECOMMENDED MARKETING STRATEGIES

Given the large number and geographical dispersion of Tiger Vision's customer base, it is imperative for Tiger Vision to have a thorough, well-planned marketing strategy. The following four avenues should play prominent roles in this strategy: (1) training academies; (2) selected trade journals; (3) major trade shows; and (4) field testing and demonstration programs with the largest law enforcement agencies.

An estimated 600 local police departments operate their own **training academies**, joined by an additional, but undetermined number of for-profit academies. Texas alone is home for 103 public and private academies. The more established academies train several thousand officers across the nation each year. Providing Tiger Vision demo units for the training sessions is an excellent means of familiarizing future officers with Tiger Vision's distinct capabilities and advantages.

This strategy works well for ITT, which operates its own training academy. Two other academies contacted during this research were receptive to having Tiger Vision available for use and demonstration, and there is every reason to expect many of the remaining academies to be equally receptive to Tiger Vision demo units.

Selected **trade and association journals**, such as **The Brigade Quartermasters, The Tactical Edge, Police and Security News, Law Enforcement Technology, Law & Order, Police Chief,** and **Law Enforcement Product News**, provide opportunities for independent product reviews and advertisements. Product reviews are an especially influential and low-cost marketing tool for a new product like Tiger Vision.

Major trade shows and conferences, such as the National Tactical Officers Association's Annual Tactical Training Course and Conference and the International Association of Chiefs of Police, complement the preceding marketing strategies by offering personal contact with a large number of potential customers along with the opportunity to demonstrate Tiger Vision first-hand.

Direct sales calls to the larger law enforcement agencies, such as New York City Police Department with over 28,000 full-time officers, offer efficiencies in demonstration and marketing programs. The largest agencies typically have a technical services unit providing equipment and technical support to the officers department-wide. Detective William McNulty of the NYPD Technical Services Unit said he is constantly evaluating and buying new equipment. Regarding the potential for night-vision equipment, McNulty says there are an additional 4,000 to 6,000 officers in NYPD's special surveillance and narcotics units who could also benefit from night-vision equipment.

X. RECOMMENDED PRICING STRATEGIES

Pricing is ***the*** primary factor for selecting one brand of night-vision equipment over another in most cases. Durability and performance are the other selection criteria. As a new entrant into the marketplace, Tiger Vision will be more quickly recognized if it carries a more affordable price tag.

Tiger Vision's anticipated retail price point is in the $500 to $750 range, and this is exactly where it should be to compete most effectively in the marketplace. Competing night-vision devices are becoming more affordable, but their prices are still higher than Tiger Vision's expected range by a factor of two, three, four, or even more times. A notable exception is ITT's lower-end equipment at just under $1,000, but Tiger Vision's distinct price and operational advantages, targeted toward a budget-conscious customer base, lead the authors to recommend that Tiger Vision pricing be set at the lowest possible point that still allows an adequate profit margin.

The price and selection in night-vision equipment for law enforcement is much more competitive than it was just a few years ago. Performance and optional accessories have greatly improved. The newest efficiencies in microelectronics are being translated into manufacturing and design advancements and lower manufacturing costs. If Tiger Vision is to get firm footing into the marketplace, highly competitive pricing is key to ensuring its longer-term commercial success.

REFERENCES

Telephone Interviews

Adcock, Gene, VP Marketing, Night Vision Equipment Company, Emmaus, PA; 610/391-9101.

Aguilera, Robert, Market Segment Leader, Santa Barbara Research Center (part of Hughes Aircraft, which, along with TI, is being purchased by Raytheon), Goleta, CA; 805/562-4286.

Akers, Monte, Major, Texas Army National Guard, Counter-Drug Program Unit, Austin, TX; 512/406-6915.

Baleria, David, Training Manager, Jackson County Sheriff, Jackson County, OR; 541/776-7692.

Bellizzi, John, Executive Director, International Narcotics Association, Albany, NY; 518/463-6232.

Brooks, Ron, Santa Clara County Specialized Enforcement Team (and Past President of the California Narcotics Officers Association) Santa Clara, CA; 408/277-1157.

Casavant, Andy, President, Midwest Tactical Training Institute, Homer, IL; 217/896-2300.

Comparetto, Mike, Lieutenant, New York Drug Enforcement Agency Task Force, New York City, NY; 212/620-4942.

Cowsert, James, Sergeant, Duncanville Police Department, Criminal Investigation Unit, Duncanville, TX; 972/780-5085.

Donohue, Phil, Special Agent in Charge, California Department of Justice, Bureau of Narcotic Enforcement, San Diego, CA; 619/645-2380.

Fernandez, Bill, Supervisor, U.S. Drug Enforcement Agency, Technical Support Group, San Francisco, CA; 415/436-7753.

Gerdes, Suzanne, President, OEI Imaging (Optical Electronics, Inc.), Tuscon, AZ; 520/889-8811.

Harding, Allen, Marketing Rep, Electro-Optical Systems Division, Litton Industries, Phoenix, AZ; 602/303-8954.

Hecht, Avron, Electro-Optical Engineer, U.S. Federal Bureau of Investigation, Engineering Research Facility, Quantico, VA; 703/630-6710.

Henderson, Ron, Crime Prevention Officer, Augusta Police Department, Augusta, ME; 207/626-2370.

Hosek, Dan, Project Manager, U.S. Army Center for Night Vision and Electro-Optics, Fort Belvoir, VA; 703/704-3130.

Jamison, Ken, Owner, North American Integrated Technology, Rockland, CA; 916/630-8993.

Johnston, Chris, Sales Agent for Western U.S., Raytheon Texas Instruments Systems, Seattle, WA; 425/392-8884.

Kneeshaw, B., Captain, San Diego County Sheriff's Department, Emergency Search Team, San Diego, CA; 619/467-4541.

Licensing Officer, U. S. State Department, Office of Defense Trade Controls, Washington DC; 703/875-6644.

Lorraine, Marketing Rep, Electrophysics Corp., Fairfield, NJ; 201/882-0211.

Manning, R.M., Supervising Officer, Fort Worth Police Department, Special Weapons and Tactics, Fort Worth, TX; 817/871-8851.

McNulty, William, Detective, New York City Police Department, Technical Services Unit, New York City, NY; 718/352-1409, ext. 130.

Monson, Tom, Director, Crime Prevention Resources, Medford, OR; 541/779-0016.

Nuemayer, Jim, Detective, Missoula Police Department, Missoula, MT; 406/523-4691.

Owen, Andrew, Product Manager, Inframetrics, Inc., No. Billerica, MA; 978/670-5555.

Palmer, Gary, Chief Engineer, ITT Night Vision, Roanoke, VA; 800/448-8678, ext. 5525.

Reaves, Brian, Editor, Bureau of Justice Statistics, Washington, DC; 202/616-3287.

Saenz III, Lupe, Technician, U.S. Border Patrol, Laredo Sector, Laredo, TX; 956/723-4367.

Smith, Doug, Program Manager for Tactical Training, Texas A&M Engineering Extension Service, Law Enforcement Training Division, College Station, TX; 409/845-6678.

Taylor, Steve, Captain, Tracey Police Department, Tracey, CA; 209/831-4578.

Wentworth, Earl, Lieutenant, San Diego County Sheriff's Department, SWAT Team, San Diego, CA; 619/467-4541.

Whitlock, Richard, Attorney, Oregon Attorney General Office, Criminal Justice Division, Salem, OR; 503/378-6347.

Literature Sources

Law Enforcement Management and Administrative Statistics, 1993: Data for Individual State and Local Agencies with 100 or More Officers, Bureau of Justice Statistics, September 1995, NCJ-148825.

Op. cit., **Local Police Departments, 1993,** April 1996, NCJ-148822.

Op. cit., **Sheriffs' Departments, 1993,** June 1996, NCJ-148823.

U.S. Commercial and Military Infrared System Markets, Frost & Sullivan, April 1995; 415/961-1000.

Encyclopedia of Associations, Gale Research, 1997 edition.

"ITT Night Vision Technology Gaining Foothold in Civilian Marketplace – But Not Without Its Challenges," **Defense Electronics,** June 1994, P. 16(2).

Nielson, Eugene, "Night Vision Equipment: An Important Tool for Today's Law Enforcement Officer," **Police and Security News,** May/June 1996.

Simpson, John, "The Care and Feeding of Police Snipers: Part VII. Night Sniping," **Police and Security News,** July/August 1997.