Title: Product Development Plan for the 2X6 Extended Eye Relief Pistol Scope

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Abstract: This report discusses the process by which a company conceived and developed its 2X6 Extended Eye Relief Pistol Scope. We document and describe the various stages of the project, including: management aspects, from the investigative phase, the design phase and on through the assembly and evaluation of the prototype.

PRODUCT DEVELOPMENT PLAN FOR THE 2X6 E.E.R. PISTOL SCOPE

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EMP - P8910

(A)

2x6 E.E.R PISTOL SCOPE

LEUPOLD AND STEVENS

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INTRODUCTION

In February 1987 Leupold recognized the necessity of entering the variable eye relief pistol scope market. However, due to a lack of economic and technology resources, the company could not proceed until February 1988.

This report discusses in detail the process by which Leupold conceived and developed its 2X6 Extended Eye Relief Pistol Scope (2X6 EER). This report documents and describes the various stages of the Leupold project, including: management aspects; the investigative phase; and the design phase through the assembly and evaluation of the prototype.

1 EXECUTIVE SUMMARY

Leupold is a manufacturing corporation that produces rifle, and pistol scopes. The company has one manufacturing plant in Beaverton, Oregon. The company markets its products in both the United States and overseas in Europe, and the South Pacific.

1.1 Management Aspects

Leupold management wanted to have the 2x6 EER pistol scope three years ago. At that time, strong interest was expressed that this scope should be out in the market right away. However, resources were not available to go ahead with it. At that time, none of Leupold competitors had a variable pistol scope in the market. Leupold could have entered the market and completely dominated it.

Today, Leupold is playing catch up with its competitors and the market. The management believes that in order to sustain interest, and any kind of sales, Leupold's reputation for being the best quality in the pistol scope market must be maintained. The marketing department's objective is to maintain Leupold's position and market share in the shooting sports as the quality market leader. On the other hand Leupold's management understands the necessity of releasing new successful products into the market, to fill those market niches and to do so expeditiously.

To maintain Leupold's position in the market:

* Leupold has to bring to the market new products like the 2x6 EER pistol scope.
* The company has to have a product line that Leuopold customers will carry and value.

It will take a big effort to get the 2x6 EER product to market. The 2x6 EER pistol scope is more than just another rifle scope or pistol scope.

From the marketing standpoint, the 2x6 EER pistol scope has the features that are needed: cosmetically attractive; extreme clarity; fog/water resistance; light weight; lifetime warranty; adjustments (pos. click, windage, elevation); american made; excellent service record, and customer support; eye relief; overall quality; multicode lens/light gathering; and other desirable features.

From the manufacturing standpoint, the 2x6 EER pistol scope has some real manufacturing "oddities". Among these difficulties are: it is different mechanically; the lenses are smaller; and the requirement that the scope function under high impact use, like in a .44 Magnum pistol. All these things are going to make it tough for the engineers. It is probably going to take a higher level of effort than would normally go into the usual new scope project. If the average effort for a new scope is at a level of 5, management expects the 2x6 EER pistol scope will take about a level of 8 to bring it into production and to get it on the shelf to where marketing can sell it. The estimate is

the overall effort throughout the organization, not just in Engineering or Manufacturing Engineering.

Both the Engineering and Manufacturing managers understand this challenge. The engineers and technicians who work for these managers are very capable, and also understand the challenge. It is part of the duty of the people on this project team to make sure they understand what a challenge this is and that their organizations also understand this challenge.

1.2 The Human Factor

Management is aware that Leupold is understaffed in Engineering and Manufacturing Engineering. In terms of product development Leupold does not have the staff to do the 2x6 EER pistol scope project, along with all the other things they must do. Manufacturing Engineering is understaffed, Design Engineering is understaffed, and the Tool Room is also understaffed. In the long-term, Leupold hopes it will have more resources.

Looking at Leupold's structure and how decisions are made, and how those decisions are implemented, one needs to consider different factors like: climate; norms; procedure; goals; objectives; and the mission of Leupold as an organization. Most of those factors are there, but the rational approach of decision making is not followed that closely.

1.3 Project Structure

The organizational structure for the 2X6 EER Pistol

scope project includes the Corporate Project Manager, the Project Manager, the Project Leaders and the Project Team. However, the Project Manager's role has not yet been completely defined, because the Project Manager does not yet have authorization from management to go through to task completion. This situation has modified the project team structure into a collegial project structure.

Figure # 1, illustrates the structure of the 2X6 EER Pistol Scope project.

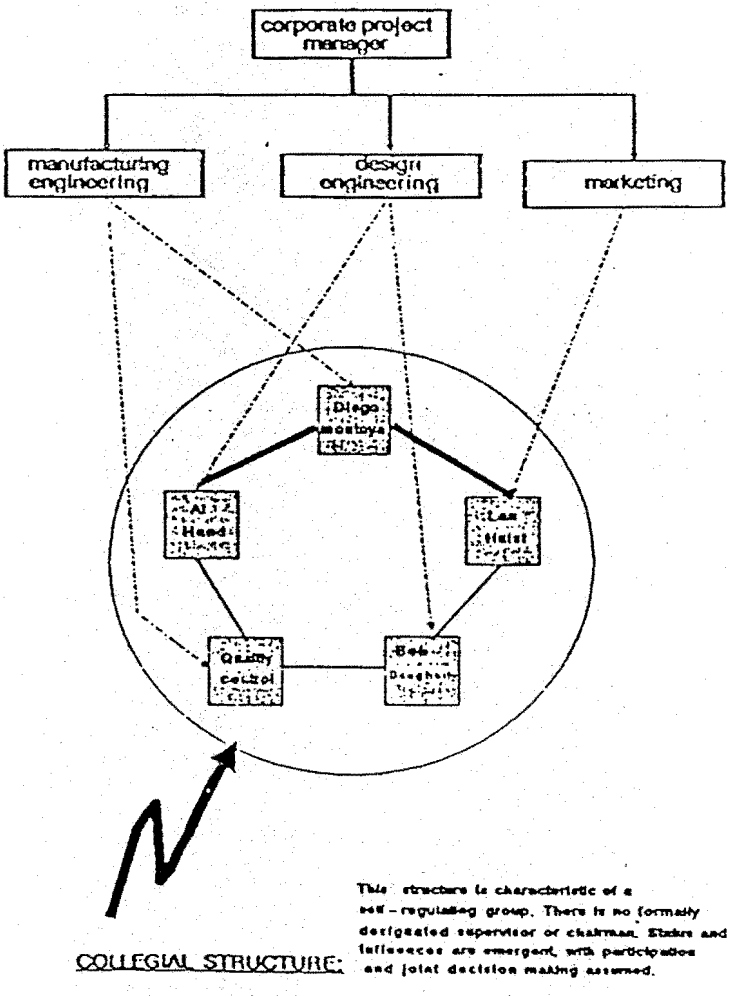


FIGURE # 1

1.4 Communication

" The successful execution of high tech projects requires a disciplined approach that should use conventional project planning and control techniques as well as other innovative approaches. However, the success or failure of projects depends on the prevailing levels of communication, cooperation, and coordination.

SOURCE: Project Management In Manufacturing and High Technology Operations. (Adedeji B. Badiru, Wiley Series In Engineering Management)

In the development of the 2X6 Extended Eye Relief Pistol Scope Project proper communication has been very important, so those that have been, or will be affected by the project should be informed early on of: i) what is being planned; ii) when the plan is to be executed; iii) who is in charge of what; iv) why the project is needed; v) what is the expected cost; and vi) what the scope of the project is. The style of communication used in development of the 2x6 EER Project has been basically: i) formal written memos (see memos); ii) business meetings; and iii) face-to-face work. The organization has invested time and energy in creating good-quality, face-to-face, and written communication mechanisms. This situation has created an invigorating climate that should exude commitment, which will make the successful completion of the project more likely.

2 INVESTIGATIVE PHASE

The investigative phase consists of product definition and analysis to determine what opportunity exists for a proposed product. It starts with a Marketing Product Description. This phase is led by Marketing with inputs from other divisions. It includes input from Engineering that the product is technically feasible.

2.1 Market Situation Analysis

The market situation analysis is concerned with which unit to use as the basis for analysis and planning. The components of this analysis are listed below and shown on figure # 2. a) Product market definition which facilitates estimating demand; b) Customer analysis makes estimates of demand; c) Key competitors analysis helps the marketing people to evaluate the competitor's strategies; d) Environmental analysis is based on the identification of future environmental forces; e) Marketing strategy analysis is the last component of its element; and its function is to define the strategic situation.

2.1.1 Product Market

The characteristics of the pistol scope market in the U.S.A. is like everywhere else. There are three major activities: hunting; informal target shooting; and formal target shooting.

Hunting and Informal Target Shooting are the two

areas where the Leupold scope would be sold.

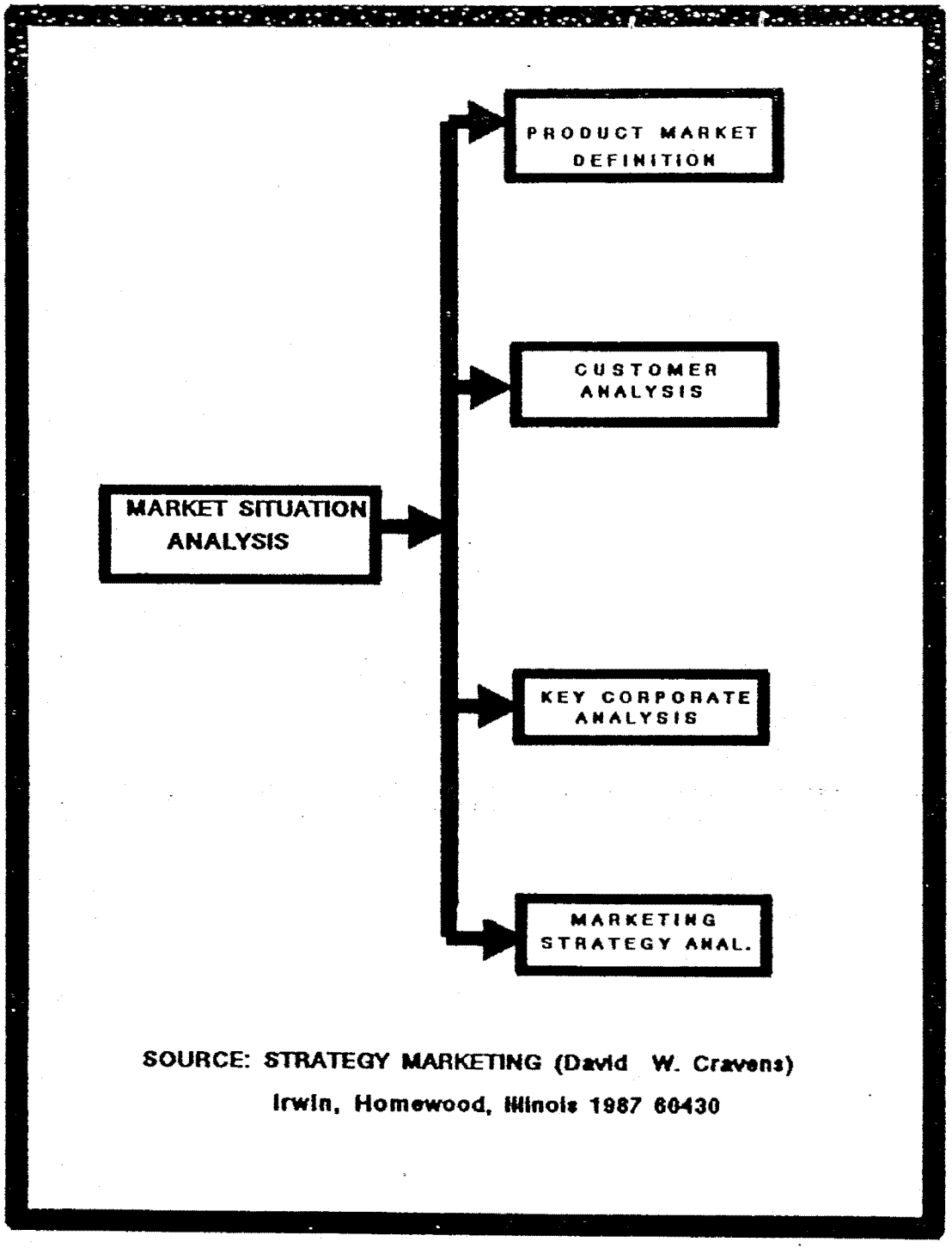


FIGURE # 2

Formal Target Shooting would be only a minor market for Leupold. There are some competitions of formal target shooting that use scope sights. However, most costumers use low power scope sights and the 2X6 would not be applicable. While silhouette pistol competition would use scope sights like the 2x6, this type of competition has not caught on yet.

The National Rifle Association (NRA) has a hunter class that would use the 2x6 scope sight, but it also is not very popular. So, hunting and informal target shooting are the primary elements of the market. Table # 1, shows market segmentation for the pistol market.

PISTOL		MARKET		
		Informal Target Shooting	Formal Target Shooting	Hunting
2 X	silver	X	X	EMerging Market
	black	X	X	EMerging Market
4 X	silver	X	X	EMerging Market
	black	X	X	EMerging Market
2X6 EER	silver	X	X	EMerging Market
	black	X	X	EMerging Market
2X6 EER		TARGET MARKET	Doesn't Apply That Well	Merging Market

TABLE # 1

Market Concentration: Traditionally Leupold has sold most heavily in areas that have the most population. The Northeast is the # 1 area, followed by the South and Southeast. Shooting is pretty well spread throughout the general population. While there are some exceptions, as certain big cities don't have many shooters, it generally follows the population spread.

Market Size: From Shooting Times/September 1988.

" Generally, people who buy pistol scopes are heavier users of handguns than rifle scope buyers are of rifles. Just about everyone who buys a rifle puts a scope on it. This is not true of the person who buys a pistol. However more and more people buying handguns are putting scopes on them."

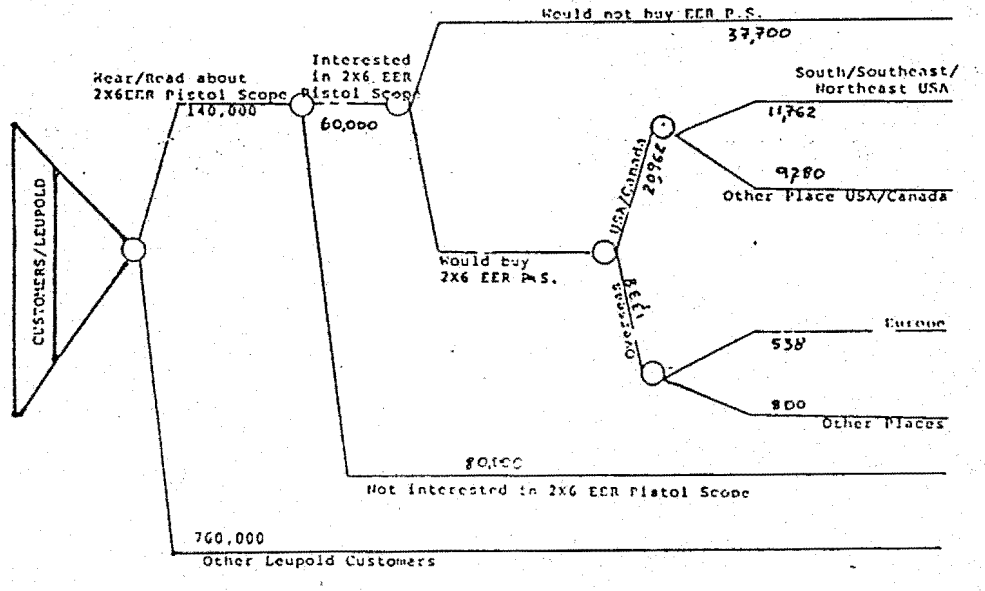


FIGURE # 3

Figure # 3, shows the market size, and geographic distribution of the potential market for Leupold scopes for a five-year period. The explanation of figure # 3 follows, and is based on information released from Leupold Marketing department.

" Leupold's potential market for rifle scopes, pistol scopes, and binoculars is about one million people. Out of those, 140,000 would hear or read about the 2x6 EER pistol scope, and 60,000 out of that 140,000 would be interested in further information about the 2X6 EER Pistol Scope. Of these 60,000 people, 22,300 would buy the 2X6 EER Pistol Scope; 20,962 in the U.S.A. & Canada, and 1,338 overseas (Germany, Sweden, Finland, England, Australia, New Zeland, and Japan) ".

In the foreign markets, except for Australia, it is pretty much all target shooting. In Australia, there is some hunting with pistol scopes. Still almost all exports are for recreational shooting, especially target shooting.

Leupold will produce 200,000 scopes in 1990. Three percent of that production will be 2x6 EER pistol scopes to satisfy the demand of its potential customers.

2.1.2 Customer Analysis

Individuals who do pistol target shooting and pistol hunting are potential customers of the 2x6 Extended Eye Relief Pistol scope. When a potential customer first gets interested in such shooting activities, he or she usually starts with a 2x scope, which is easier to hold steady. But as time goes on, the customer typically wants a more powerful scope on his

handgun.

The 2x6 gives him what he will be looking for. In the past there were not many handgun shooters, and the one or two scopes like the kind Leupold presently makes have adequately handled the market.

However, as more people get into pistol shooting and get to be better shots, they will be looking for something just a little bit better in a scope.

It is this more experienced shooter who is the potential customer for the 2x6 EER scope. It is not a scope for the novice shooter. But it is also a scope which can grow along with the shooter.

2.1.3 Key Corporate Analysis

The competitors for the 2x6 EER pistol scope are: Burris; Tasco; Bushnell; and Redfield.

For lower priced scopes, the major competitor is Tasco. Burris has the most pistol scopes in the market. This is a consequence of Burris being more responsive to specialty products than Leupold. For instance Burris has pistol scopes of all magnifications from 1x to 7x. It also produces a 1x4 variable and a 2x6 variable. Some of Burris' scopes have adjustable objectives in addition to the fixed objective.

Redfield has had some market participation in the past but not much. However, they now have a 2x6 Extended Eye Relief pistol scope, which may help them reach a higher position in

this specific market.

Bausch and Lomb (Bushnell), has not been a key player in the handgun market before, but should improve with its 2x6 EER pistol scope, since it has produced very good 2x and 4x EER pistol scopes.

Tasco, has the reputation of being a decent value product for the money. They promote well, and have many products in their line, although in pistol scopes their line is somewhat limited. However, in general, they have many products and they promote well. Their plan appears to be to continue doing what they are doing.

In order to market the 2X6 Extended Eye Relief Pistol Scope, it is necessary to analyze the different aspects of each competitor's marketing of variable eye relief pistol scopes.

The above analysis of Leupold's competitors in the 2X6 EER Pistol Scope market was based on the information given in figures # 4A, 4B, 4C, and 4D. Figures # 4A through 4D analyze the strengths, limitations, plans of each of Leupold's competitors, and evaluate their strategies in relation to to Leupold's marketing of pistol scopes.

FIGURE # 4A

COMPETITOR ANALYSIS BURRIS

COMPANY Burris. PRODUCTS Scope & Sights

ADDRESS 331 E. 8th St. Greeley, CO 80632

TELEPHONE (303) 356-1670 SALES 75,000,000

SIC 3832 Mnfr Rifle & Handgun Sights & Scope Mounts

BANK Intrawest Bank ACCOUNTS Fuller & Jones

LEGAL Cls Houtchnes & Daniels

PRESIDENT Don J. Burris VP PR/MFG John P. Carty

MARKET INDICATORS

i) Doesn't seem to promote very much.

ii) Has a low profile in terms of production.

iii) Does some space advertising.

iv) Is always lower priced than Leupold by roughly 20%.

v) Doesn't have a good distribution system.

PLAN

The Burris plan is to do what it has been doing for the last 15 years, the same thing its president did when he was at Redfield: bring out as many products as possible and fit into as many market niches as possible. Burris is product line sensitive.

FIGURE # 4B

COMPETITOR ANALYSIS BUSHNELL

COMPANY Bausch and Lomb PRODUCTS Scopes/telescopes/glasses

Bushnell

SALES 450,000,000

MARKET INDICATORS

i) Promotion in Leupold's market has not been as good as it can be, nor has it been as good as Leupold's.

ii) Is priced fairly evenly with Leupold.

iii) Has a distribution system every bit as good as Leupold is.

iv) Bausch and Lomb products are just now beginning to be good for the market. It had a weak product before.

PLAN

Bausch and Lomb plan seems to be two pronged: 1) improve its products, and 2) improve the quality of its promotion. It also wants to do a better job of promotion and product which has been proven in both directions.

FIGURE # 4C

COMPETITOR ANALYSIS REDFIELD

COMPANY Redfield PRODUCTS Binoculars/Scope/Telescopes.

ADDRESS 5800 E. Jewell Ave. Denver, CO 80224

TELEPHONE (303)757-6411 SALES 20,000,000

MARKET INDICATORS

i) Promotion is not as good as Leupold's.

ii) Excellent advertising.

iii) Does a little bit better job in getting the word out in terms of information to their writers, actually to magazine.

v) Pricing strategy seems to be to price all over the map and see what works. There are lots of different kinds of prices for their products.

v) Product distribution is on a par with Leupold's.

vi) Redfield products, are inferior in quality to Leupold's. Redfield products don't hold up to the tests that Leupold gives to its products.

COMPETITOR ANALYSIS REDFIELD (CONTINUATION)

vii) Redfield's reputation has definitely slid over the last ten years, whereas Leupold's reputation has held up.

PLAN

Redfield's plan is to go the product route somewhat like Burris, but not necessarily to make all products themselves, but to import some. It seems Redfield is already importing some of its products. Redfield is promoting more,but it still has a long way to go. Redfield plans to improve its promotion and somewhat upgrade its product line, which is different from what it has been doing for half a dozen years.

FIGURE # 4D

COMPETITOR ANALYSIS TASCO

COMPANY Tasco PRODUCTS Binoculars/telesc/scopes Sights.

ADDRESS 7600 NW 26th St. Miami, FL 33122

TELEPHONE (305)591-3670 SALES 85,000,000

PRESIDENT G. Rosenfield VP PR/MFG Sheryl Rosenfield

MARKET INDICATORS

i) Tasco's strategy in promotion is to promote everything heavily.

ii) Good promoter in terms of advertising.

iii) Excellent promotions.

iv) Low price product oriented.

v) Distribution is excellent.

vi) Product is of fair quality.

PLAN

Tasco's plan appears to be to continue as before: promote a lot; have a lot of products in the line, although in pistol scopes it doesn't have a lot; and produce adequate products at low prices.

Using this competitor analysis in Figures 4A through 4D as well as data collected from: i) Leupold's marketing strategic plan; ii) Leupold's distributors and retailers; iii) Leupold's marketing and financial consultants; iv) written communication with state agencies; v) brochures and price lists from Leupold competitors in the pistol scope segment, vi) Moodys (Portland State University Library), and vii) Million Dollar Directory (Portland State University Library). Table # 2 shows the subjective rating assigned not only to Leupold, but to each of Leupold's competitors in the 2X6 EER Pistol Scope. This rating was assigned to each component of the strategic mix (price, distribution, promotion, product).

A Price rating from A to D was assigned based on how reasonable the price of the scope is to the customer in relation to the price of similar scopes in the market.

A Distribution rating from A to D was assigned based on how well the company releases its products to dealers and distributors on the terms, and within the times previously announced.

A Promotion rating from A to D was assigned based on how promptly and generously samples were given to magazine writers, distributors, dealers, and representatives before the product is released to the public.

A Product rating from A to D was assigned based on the capability and flexibility of the scope to adjust to the customers' needs and expectations.

COMPETITOR MARKETING STRATEGY/COMPARISON
- 2 X 6 EER PISTOL SCOPE -

COMPANY	MARKETING STRATEGY			
	PRICE	DISTRIBUTION	PROMOTION	PRODUCT
REDFIELD	A	B	B	C
TASCO	A	A	A	C
BURRIS	A	C	D	B
BUSHNELL	A	B	B	B
LEUPOLD	A	B	B	A

Excellent ----- A
Good ---------- B
Fair ---------- C
Poor ---------- D

TABLE # 2

2.1.4 Marketing Strategy Analysis

Distribution: In marketing its new 2X6 EER scope Leupold will use its existing distribution channels. Leupold's distribution system is a two tiered or two step system; with distribution from Leupold to the distributor and then to the dealers, and finally to the consumer.

Leupold should consider revising its distribution strategy by:

* Improving delivery
* Keeping distribution bases clean
* Not changing the label. (Representatives of the distributors had mixed feelings about adding a new label.)

Pricing: Pricing is partly a function of where Leupold stands in the marketplace with respect to its competitors, and partly a function of what it costs to make the product. These factors are what Leupold has generally looked at in pricing.

Promotion: Leupold's marketing department has some money for promoting and advertising the 2x6 EER scope. The strategy is to give a few scopes to writers and journalists around the country for them to examine, use and critique, and then to write about in a magazine.

Leupold's distribution strategy should include:

* Advertising "made in USA".
* Advertising to consumers.
* Working more with trade groups.

2.2 Product Description

The description of the 2X6 EER Pistol Scope includes two section: i) functional description, which explains in detail the functionability of the scope parts (variable power, adjustment, capability, magnification, erector system, spacing); and ii) technical description, which is a technical analysis of the different specifications the 2X6 EER Pistol Scope is supposed to meet based on marketing requirements.

2.2.1 Functional Description

The 2x6 is an extended eye relief scope designed specifically for the handgun shooter. The eye relief of about 18" accommodates the standard handgun shooting position with arm extended.

The higher variable power portion of the scope will be difficult to hold steady with the arm extended holding a heavy handgun. For this reason low power is normally used, and most handgun scopes are in the 2x-4x range. Leupold currently has 2x and 4x handgun scopes in the market. Nevertheless, shooters sometimes desire scopes with a little higher power, such as for target shooting or for hunting at a distance. However, the primary use of the scope would still be at low power, i.e., 2x.

The variable power scope gives the shooter the option of deciding what type of power he wants to use for different applications. By simply changing the adjustment, one has both low power capability for a steadier image, and higher magnification

when that is needed. This gives customers more flexibility.

Target shooters, in particular, would want to use the higher power. They generally have a little steadier hand, and should find it less difficult to hold steady the higher magnifications.

One really doesn't want magnifications much above 6x in a handgun scope because it would be too difficult to hold steady. One could never handle a 12x or 16x power scope at arm's length. It just wouldn't be steady enough.

The mechanism for changing magnification. There is a three lens system within any rifle scope, whether it be a handgun scope or a hunting rifle scope. An objective lens takes an object at a distance and presents its image within the scope. A single lens however presents an image inside the scope which is upside down.

The erector system "erects" the image, turns it around, so the image is right side up. The image is viewed through the eyepiece. Therefore, the three lens system consists of an objective lens, an erector system and the eyepiece.

The erector lens can be made to change magnification by changing the spacing within the erector system. At Leupold this change in magnification, or variable power, is accomplished by moving the power select knob.

This knob is attached to a cam tube within the system that repositions the lens for different magnifications. Every person has slightly different vision. Some customers are near-

sighted, and some customers are far-sighted. The difference in vision is usually referred to in diopters.

To accommodate the different vision of most of its customers a diopter adjustment range of -2 1/2 to +1 diopters range is necessary. At the moment, however, some Leupold scopes are fixed focus. This means they are only focused for, and are parallax free at only one range.

2.2.2 Technical Requirements

Preliminary Specifications is an engineering document containing the technical data from the initial product definition. This document will be expanded as the project proceeds to include test/inspection parameters.

Marketing originally gave the design department the general specifications for the 2X6 EER Pistol Scope, which are presented and discussed in figure # 5.

Marketing decided that the actual magnification (ACT. MAG.) of the 2X6 EER Pistol Scope, should be between 1.8-2.0 power at the low end, and a minimum of 5.6 at the high end.

Marketing also specified that it wanted the maximum possible field of view. This is a normal requirement from the marketing department, because marketing considers that its customers will appreciate as much field of view as engineering can give to the Pistol Scope.

Marketing also required that the eye relief of the 2X6 EER Pistol Scope should be at arms length, and specified the minimum and maximum distances beyond which marketing believed

it would not be able to sell the scope effectively; i.e. 26 inch maximum at low power, and 18 inch at high power.

For the scope to be cosmetically pleasing on top of a hand gun, marketing did not want the objective eye lens diameters to be too big or too small. Marketing required the scope to be 1.1 inches in diameter.

The overall length of the 2X6 EER scope was to be comparable to existing scopes. Marketing required that the maximum length of the scope be 9 inches so as to be attractive to customers.

The weight of the scope was an important consideration for marketing. The scope could not be too heavy, because the hand gun is already heavy. Weight would be a constraint for customers buying the 2X6 EER scope, so marketing specified a weight on the order of 6.0 ounces.

The minimum adjustment (MIN. ADJ.) is that adjustment the customer makes after the 2X6 EER scope is mounted on his hand gun, to align the scope with the barrel of the hand gun. 60 inches was the minimum requirement that marketing would accept, so that the customer could effectively align or "boresight" his handgun.

TECHNICAL SPECIFICATIONS

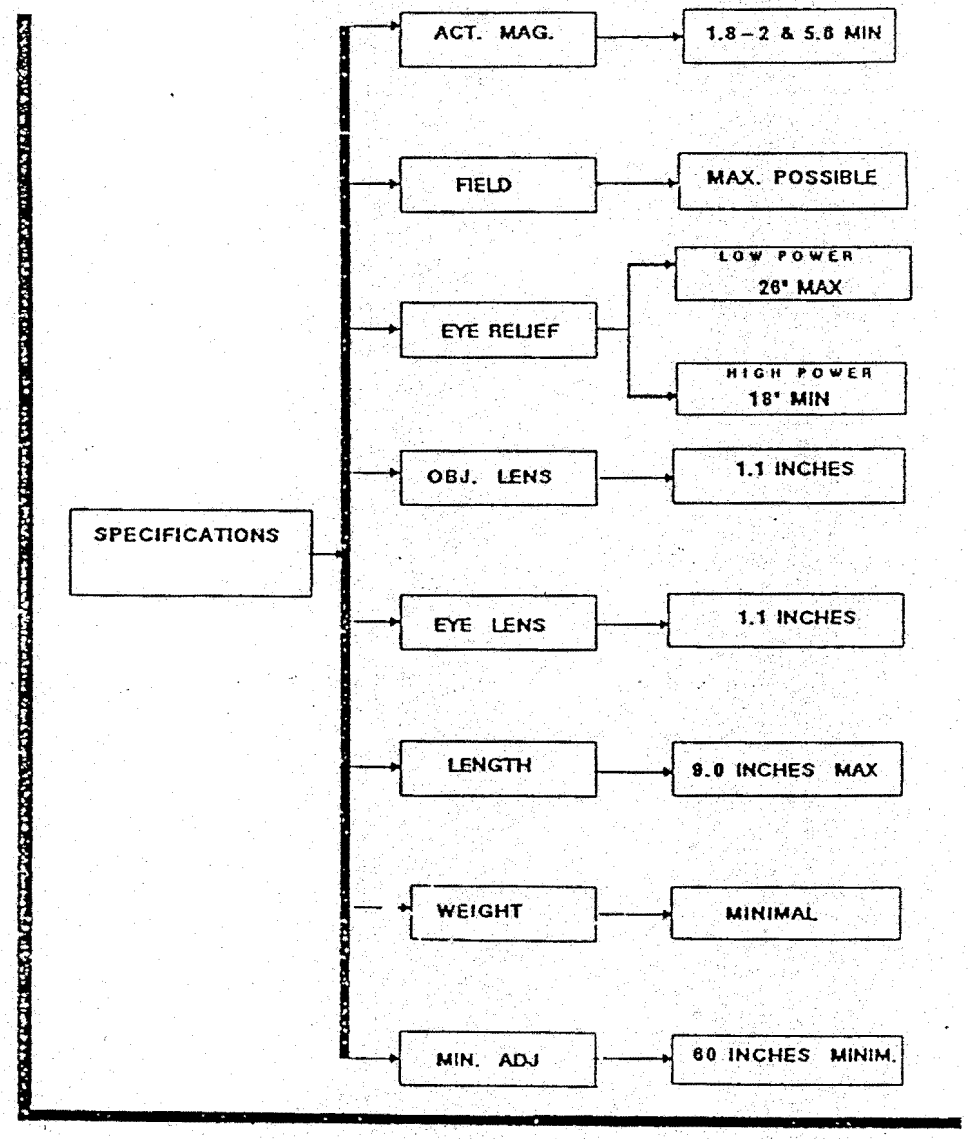


FIGURE # 5

2.3 Schedule

" The project schedule signifies the commitment of resource against time in pursuit of project objectives. The schedule should include reliable time estimates for the project tasks. The estimates may come from knowledgeable personnel, past records, elemental specificity, or statistical extrapolation. "

SOURCE: Project Management In Manufacturing and High Technology Operations. (Adedeji B. Badiru, Wiley Series In Engineering Management)

The 2x6 E.E.R. Project schedule has been divided into four stages; model development, prototype build, preproduction, and production. The activities necessary for the development of each stage can be seem in four different Gantt charts corresponding to figures #6A, 6B, 6C, and 6D respectively.

The Gantt chart uses symbols defined in table # 3 to demonstrate not only the duration and priority of each activity in a given stage, but also the interrelation created among the activies, thereby defining the critical path.

Each Gantt chart indicates a certain period of time in which a specified number of activities need to be carried out before initiating the next stage. In the case of the 2X6 EER Pistol Project, there are 4 stages, which must be accomplished in

the following order: i) model development; ii) prototype build; iii) preproduction; and iv) production.

SYMBOLS	DEFINITION
<	End of a critical activity with no relationships
+	End of a noncritical activity with no relationships
O	Milestone (no duration)
O	Critical path
!	Noncritical path
....	Slack time
----	Current Date line
▬▬▬	Start of critical activity without relationships
*	Start of noncritical activity without relationships
X	Part of activities that are completed
X	Start of activity with relationships, or end of activity with relationships. (Boldface when critical.)

TABLE # 3

The model development stage has already been completed. The Gantt chart for this stage of the project can be seem in figure # 6A. It started with the initial product definition on April 4th, 1988, and ended with project approval on August 8th, 1988.

Prototype build is presently underway, with 50% completion. The Gantt chart for this stage of the project can be seen in figure # 6B. It started with the conceptual optics design on August 5th, 1988, and as of December 5th, 1988 the second engineering model was being built. According to the critical path the prototype build stage is expected to be completed on May 28th, 1989.

Preproduction is expected to start on May 29th, 1989 with the purchase of parts to initiate preproduction assembly. The Gantt chart for this stage of the project can be seen in figure # 6C. According to the critical path this stage should not take longer than 80 days, and should be completed by August 14th, 1989.

Production is expected to start on August 21st, 1989, after the drawings, bills of materials, and routines have been updated. The Gantt chart for this stage of the project can be seen in figure # 6D. According to the critical path this stage should not take longer than 60 days, and should be completed by October 23rd, 1989.

2X6 EXTENDED EYE RELIEF
PISTOL SCOPE
MODEL DEVELOPMENT SHEDULE

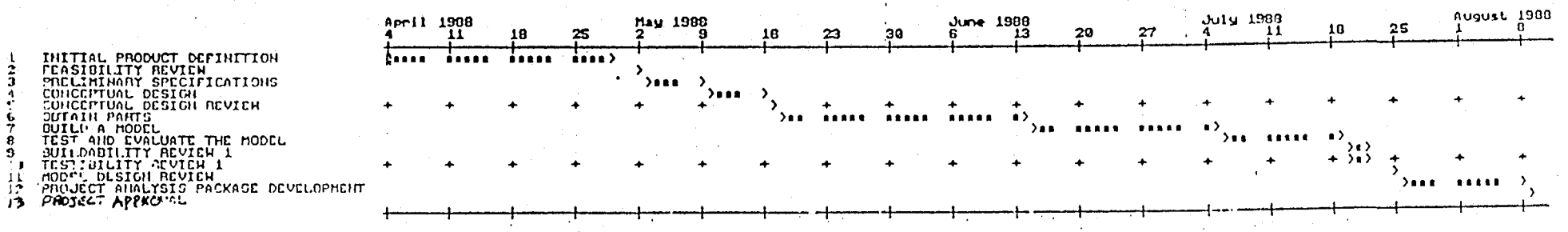


FIGURE # 6A

2X6 EXTENDED EYE RELIEF
PISTOL SCOPE
PROTOTYPE BUILD

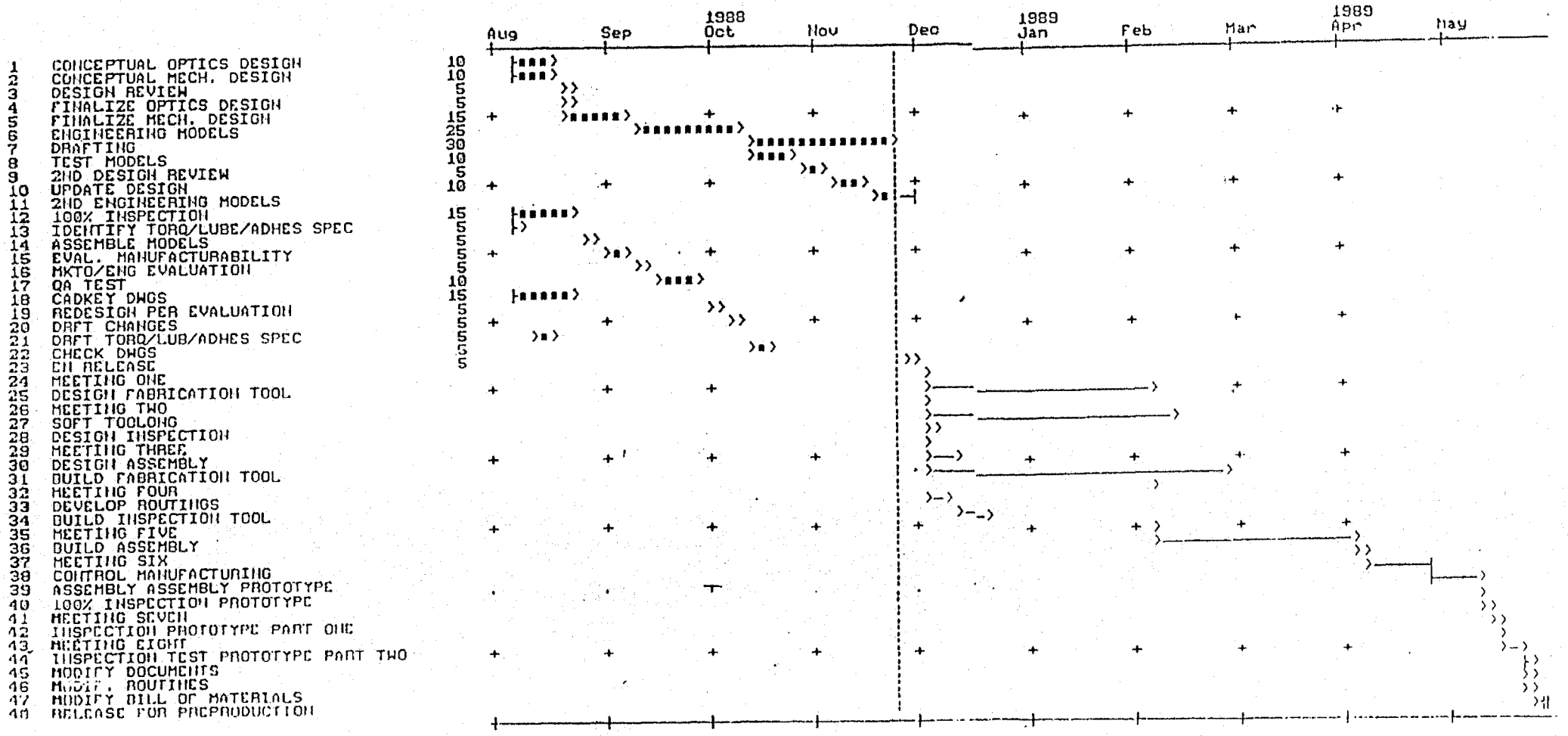


FIGURE # 6B

2X6 EXTENDED EYE RELIEF
PISTOL SCOPE
PREPRODUCTION SCHEDULE

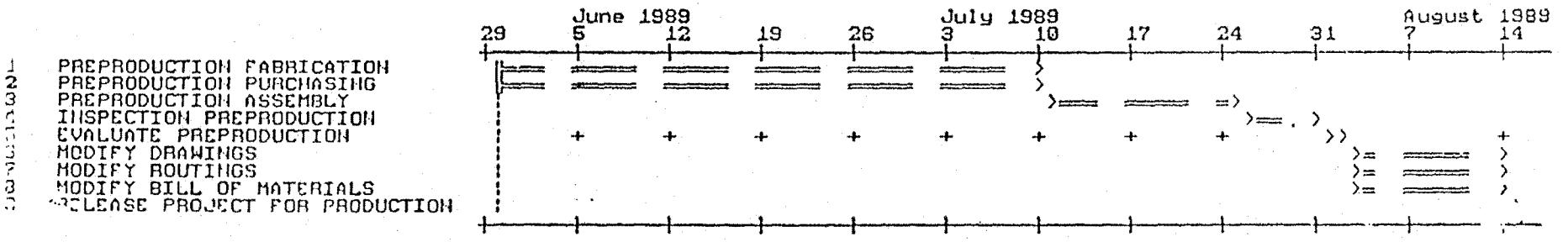


FIGURE # 6C

2X6 EXTENDED ERE RELIEF
PISTOL SCOPE
PRODUCTION SCHEDULE

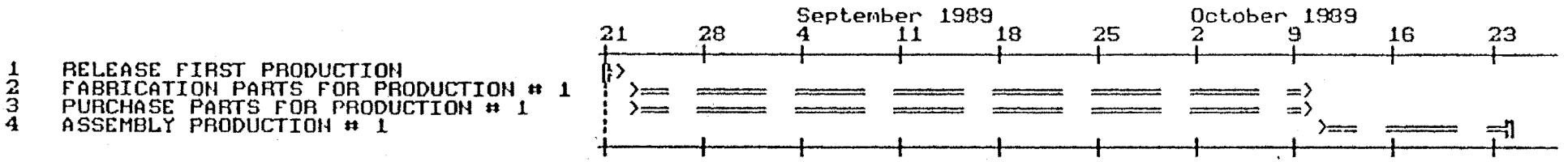


FIGURE # 6D

2.4 Technical Literature Requirements

2X6 EER SCOPE LITERATURE	
Actual Magnification	1.7
Field @ 100 Yds	21.2 feet
Optimum Eye Relief	12 – 24 inch
Unrestricted Obj. Lens DiameL	0.8 inches
Objective Diameter	1.0 inches
Eyepiece Diameter	1.4 inches
Tube Diameter	1.0 inches
Length	7.9 inches
Weight	6.0 onz
Ad. Scale Div. Eual To.	1 min of ang.

TABLE # 4

Table # 4 is a copy of a portion of the brochure which will be inserted in the 2X6 EER Pistol Scope as packaged for sale. The table gives the most important specifications of the scope, thereby satisfying the curiosity of the customer and allowing him to use the scope more effectively and to compare this scope with other scopes.

2.5 Phase-In/Phase-Out

Often with a new product introduction it will be necessary to phase out an existing product that fills the same niche as the new product. This requires good planning so as not to end up with an excess of the old product, or to be caught between phase out and phase in, without any product available.

In the case of the 2X6 EER Pistol Scope (see figure #7) this will not be necessary, since the design engineering department sees the 2X6 EER Pistol Scope as covering a brand new market. Nevertheless, the marketing department has projected that the 2X6 EER Pistol Scope could affect the 2X and 4X scope market by 5%.

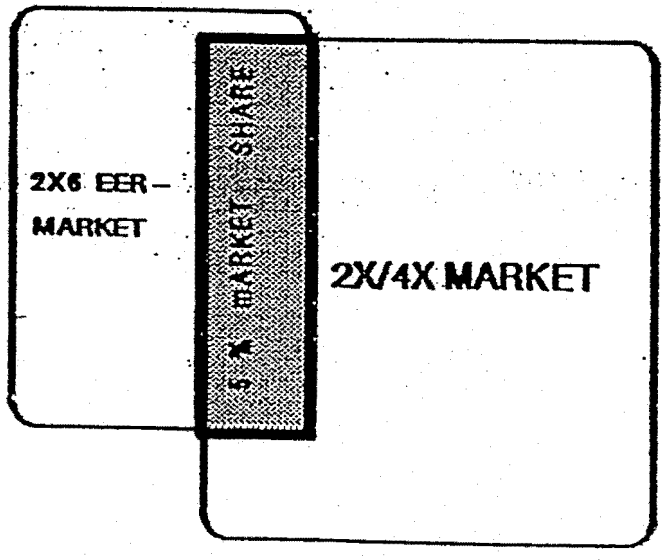


FIGURE # 7

2.6 Financial Analysis

" Financial analysis involves an analysis of the cash flow profile of the project. The analysis should consider rates of return, payback periods, breakeven point, residual values, and sensitivity. This is a critical analysis since it determines whether or not and when funds will be available to the project. The project cash flow profile, in effect, determines the economic feasibility of the project "

SOURCE: Project Management In Manufacturing and High Technology Operations. (Adedeji B. Badiru, Wiley Series In Engineering Management)

The 2X6 EER Pistol Scope Project has already been analyzed from the marketing and functionality point of view. However, finance plays a fundamental role in the decision making process of whether to proceed with or cancel this project.

The financial aspect of the 2X6 EER Pistol Scope has been organized in four major parts: i) forecast; ii) cash flow; iii) internal rate of return; and iv) breakeven point.

i) Forecast The marketing department based its forecast of the 2X6 EER Scope on projected gross sales. Marketing defined gross sales by the amount of units sold. Figure # 8 shows the predicted annual sales, from 1990 to 1994, of the 2X6 EER Scope based on a selling price of $160/scope. This

forecast was made by marketing based on its marketing experience and data collected from dealers and Leupold representatives in the U.S and the rest of the world.

Marketing considered that a five-year period is the active life of this scope. However, if customer demand increases or remains the same during this period a new forecast should be done for 1995.

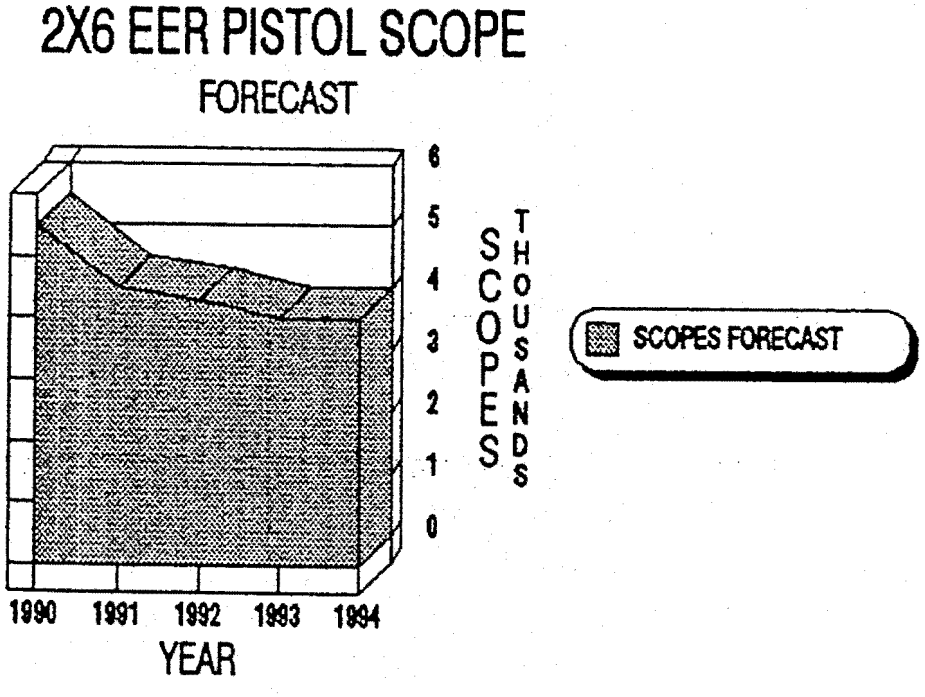


FIGURE # 8

ii) Cash Flow

Once marketing established its forecast of 22,300 EER Pistol scopes in a five year period, cash flow can be calculated. Table # 5 shows in detail the cash flow calculations, which are done based on the following assumptions:

Gross Sales: The gross sales are based on the projections of unit sales at a $160/scope selling price.

Discounts: The following discount policy was assumed: All orders and scheduled shipments amounting to at least 40 scopes to a single destination will have the following discount:

a) Payment within 30 Days 6%
b) Payment within 31 to 60 Days 3%
c) Payment within 61 to 90 Days 1.5%
d) Payments within 91 to 120 Days .....Net "

Cost Sale: The five year average of cost sales is $ 84,622/year. Cost sales figures were derived by manufacture engineering supplying the finance department with the costs of direct labor, materials and overhead.

The following is a breakdown of the material cost:

Aluminum	$3.60
Anodizing	$4.75
O Ring	$2.08
Lenses	$27.52
Packaging	$1.16
Total	$39.11

The original estimate for the unit cost of the lenses was $22.76. This was increased by 20% to account for the rise in the Yen relative to the Dollar since the start of 1987.

Gross Profit: Gross profit is calculated by subtracting cost sale from net sale (gross sales less discount). The five year average for gross profit is $201,117/year.

Project Cost: Marketing supplied finance with a forecast of advertisement and promotion dollars. The amount for 1,990 is $30,000. This amount is included in the project cost. Finance & administration costs are $14,454. This represents the amount projected to be incurred by the finance division in supporting and analyzing the 2X6 EER Pistol Scope Project.

Commissions: Commission is a straight 5% of the whole sale. It is $71378/year on the average, based upon the history of the pistol market.

Depreciation: Depreciation is projected at $8,210/year on the average, using a straight line basis of

10 years for machinery and equipment, and 5 years for tooling.

Income Taxes: Assumed to be at a 50% annual rate. Income taxes average $72,626/year over the five years.

CASH FLOW

CALCULATION

	YEAR					
	1989	1990	1991	1992	1993	1994
PROFIT & LOSS						
Gross Sales		15500	715070	556895	522811	476811
Allow & Discount		2866	132288	103026	96720	88210
Net sales		12633	582782	453869	426091	388601
Cost Sales		19166	268831	209309	191567	173894
Gross Profit		(6556)	313951	244560	234524	214707
PROJECT COST						
Engineering	57339	4065				
Marketing		30000				
Fin & Admini	11250	6204				
Total Proj cost	68589	40269				
DEPRE/COMMISS						
Comissions		758	34967	27232	25565	23316
Depreciation	27369	13685				
Tot Dir & Depr	27369	14443	34967	27232	25565	23316
TOTAL OPER EXP'S	95958	54712	34967	27232	25565	23316
NET BEFORE TAXES	(95958)	(61267)	278984	221728	208959	191391
Income Tax	(47979)	(30634)	139492	110864	95695	95695
PROFIT AFTER TAXES	(47979)	(30634)	139492	110864	95695	95695
Depreciation	13685	6842				
TOTAL FUNDS PROV	(34295)	(23791)	139492	110864	95695	95695
Capital Assets	41054					
Working Capital		5257	119117	(28366)	(6030)	(8074)
CASH FLOW	(75349)	(29048)	20375	139230	110509	103769

TABLE # 5

iii) Internal Rate of Return: The Internal Rate of Return (IRR) is based upon a discount rate of 20%, so if IRR is greater than 20% the project is feasible. Figure # 9 shows the annual cash flow of the 2X6 EER Project in a five year period.

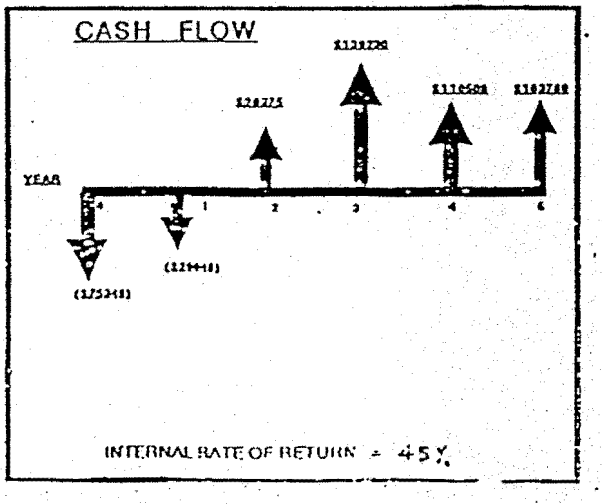


FIGURE # 9

iv) Breakeven Point Figure # 10 shows the calculation of the breakeven point, which is 1,113/scopes, through the graphic method. The following is the data utilized in this figure to calculate the sell, fixed, and total cost curves:

Sale price..... $160/scope

Variable cost..... $62.2/scope

Material cost..... $43.97/scope

Fixed cost..... $108,858/project

Forecast..... 22.300 scopes

The breakeven point is the intersection of the sell and total cost curves. It indicates the number of 2X6 EER Pistol Scopes which must be sold to recover the capital invested.

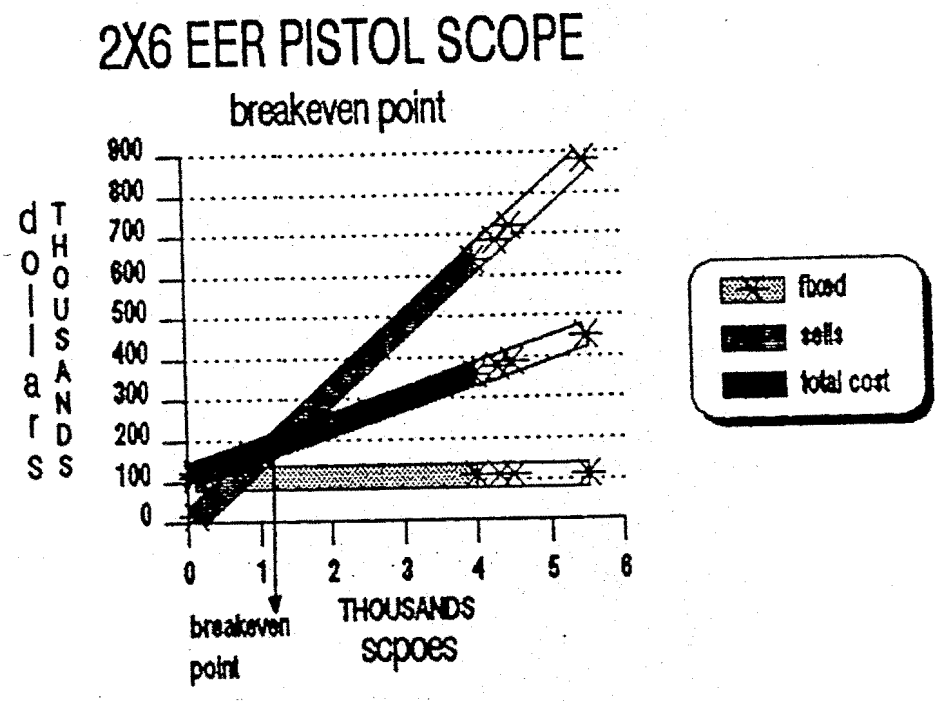


FIGURE # 10

In summary the 2X6 EER Pistol Scope is a feasible project with an Internal Rate of Return of 45%, and with a breakeven point of only 1,113 scopes, a number which will be sold within the very first year of the project.

3 DESIGN PHASE

The design phase transforms the product requirements in the Marketing Product Description into detailed design sketches and Design Specifications (DS). From the design sketches and Design Specifications, documents are created so Manufacturing can produce the product and Production Engineering can maintain on file product design for future reference.

During The Design phase all Engineering drawings are unofficially released (pre-released) on pink paper for internal use by other groups in the company. This information is distributed solely for informational purposes and is not to be used as official Engineering drawings.

3.1 Preliminary Design

The preliminary design is an analysis of the requirements of the Marketing Product Description to confirm whether these requirements can be met. It results in:

- Detailed design sketches
- Design specifications
- Preliminary design review

The preliminary design of the 2X6 EER Scope Project essentially starts when the engineering department takes over the project. Engineering begins with a preliminary analysis of the basic concepts, and the general controlling factors in the design of the scope. Engineering decides what should be modified, so that the final design will satisfy the customers. This first

design comes in the form of sketches.

The reason the engineering department does this preliminary design is to prevent wasted effort, time, and money. Therefore, Engineering first makes sure that the design specifications match the marketing specifications. Engineering then develops a preliminary design review, where engineering and marketing sit down to analyze the design.

3.1.1 Detailed Design Sketch

The drawings are the key form of communication between engineering and the various areas of Leupold. Before any model of the 2X6 Extended Eye Relief Pistol Scope can be made, engineering needs to have some design sketches. Figure # 11, shows the 2X6 EER Pistol Scope sketch.

Engineering requires a design sketch of the individual pieces of the scope, so that: i) the model maker can manufacture a model for engineering; and ii) manufacture engineering can inspect the model to decide how the assembly diagram should be done.

Engineering also uses the sketches in the design review phase with marketing to go over the tolerance of critical parts before the final design is developed.

DETAIL DESIGN SKETCH

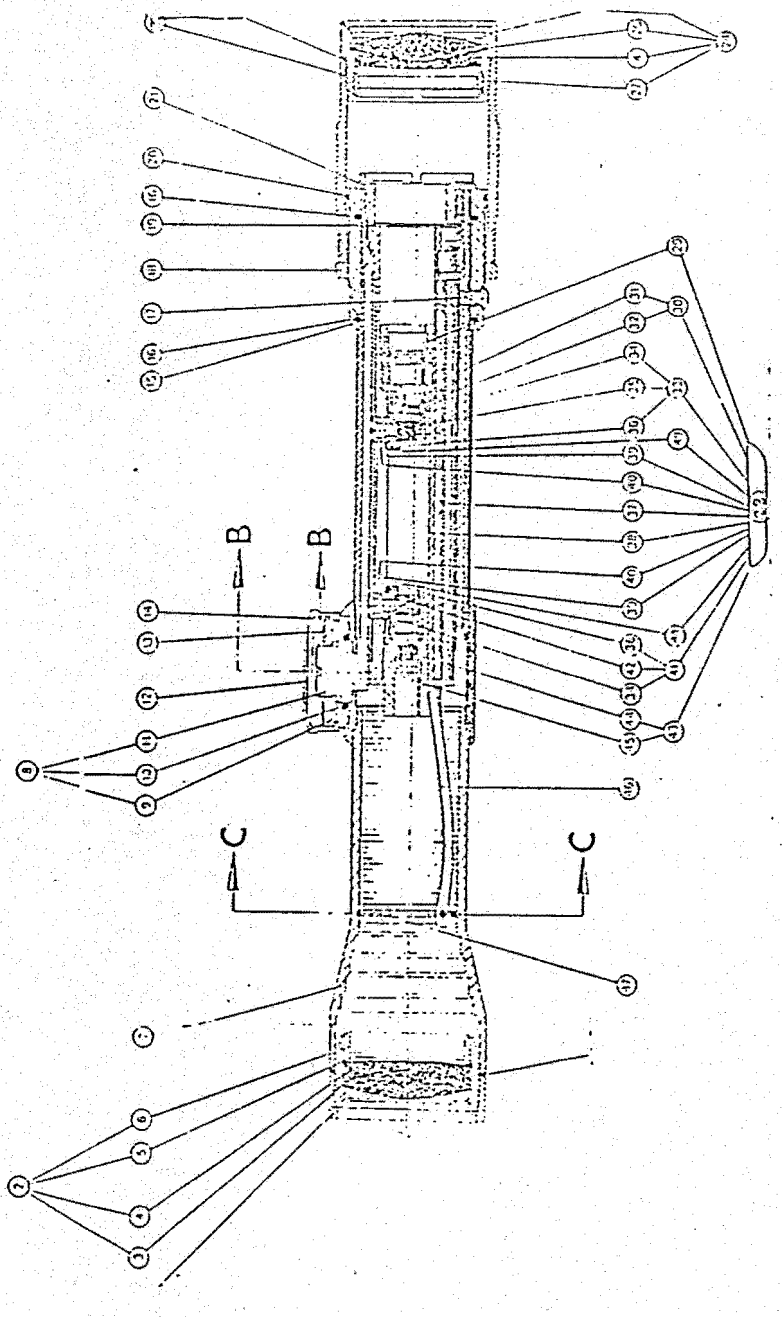


FIGURE # 11

3.1.2 Design Specifications

The design specifications (DS) are an expansion of the Marketing Product Description. They define: functional description; performance specifications; and new technologies.

Design specifications are the engineering department's technical interpretation and revisions of the general design requirements supplied by the marketing department.

The following design specifications are explained below, and appear in figure # 12.

i) The power selector adjustment: This is the device that changes the magnification. The magnification of the 2X6 EER Pistol Scope is variable, between the range of 2 power at the low end, through 6 power at the high end. The 2X6 EER scope gives the user the capability of changing magnification simply by rotating the power selector ring. It makes the 2X6 EER Scope very flexible from the stand point that it can be used at either high power or low power by the consumer.

ii) The extended eye relief (EER): The EER of the 2X6 EER Scope is very important to the consumer due to the fact that this scope is specifically designed to be used on a hand gun held at arms length. Furthermore the eye relief tends to vary with the power.

The variable portion of the 2X6 EER scope is controlled by an erector system, which is composed of a three lens group that provides not only the proper magnification, but an erect image at the reticle plane. This also affects the eye relief, and

allows design engineering to incorporate a range of eye relief from 18 inches to 26 inches.

iii) The variable power: Variable power of the 2X6 Extended Eye Relief Pistol Scope is accomplished through changing the spacing of the erector lenses, which allows the 2X6 EER Scope to change magnification. Different spacing provides different magnification, and the power selector ring is the method by which design engineering accomplishes the changing of the spacing of the lenses.

iv) New technology: There is no new technology in the design of the 2X6 EER Pistol Scope. However there are a few things which are different from the current Leupold scope line. For example: i) The erector lenses of the 2X6 EER Scope are smaller than those currently used at Leupold. These lenses require a special handling tool to be assembled, so the operator can work more efficiently; and ii) The power selector ring in the 2X6 EER Scope is an integral part of the eyepiece, which is easier for the customer to operate than a standard power selector ring.

The 2X6 EER is a new design in that it allows the eye piece shell of the scope to rotate with the power selector ring, making it easier for the customer to operate the scope.

DESIGN SPECIFICATIONS

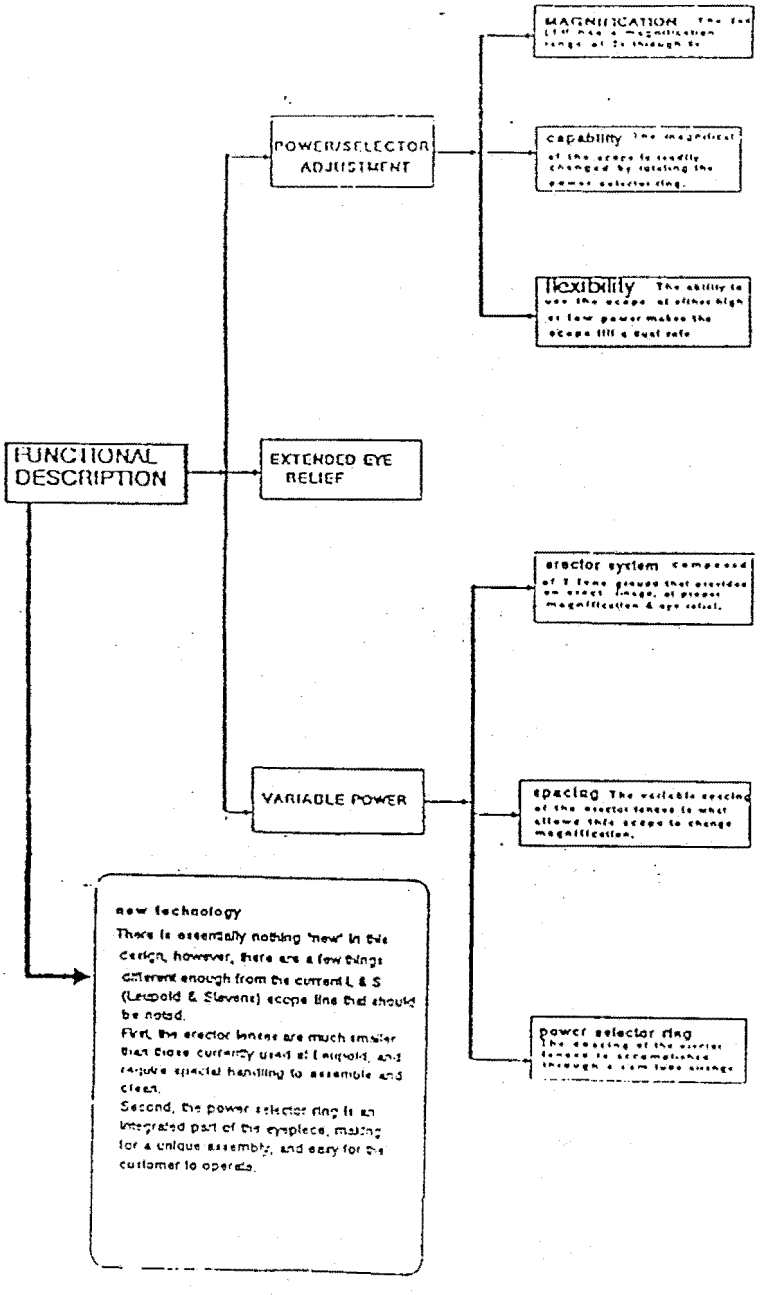


FIGURE # 12

3.1.3 Preliminary Design Review

" The Preliminary Design Review is an in-depth technical analysis of the DS (Design Specifications), and is designed by the Project Team and other selected experts. The purpose of this review is; i) to assess whether the DS and the design adequately and correctly detail the requirements in the Marketing Product Description, ii) to determine whether the product is manufacturable, testable, uses standard parts where feasible, uses state-of-the-art technology, and prudent design practice "

SOURCE: **Leupold and Stevens - Project Development manual**

The preliminary design review for the 2X6 EER is a review of the optical properties of the scope to determine whether the scope actually meets the requirements defined by marketing.

Design engineering has used new glasses in the 2X6 EER Scope, and marketing felt that the front diameter was not quite the right size for this model. Marketing wanted a bigger glass in the 2X6 EER Scope.

Design engineering then determined that the lens diameter could be increased to 28 mm without changing the lens design, allowing the design to match what marketing was looking for.

Marketing then approved the focal length of the 2X6

EER Scope, and the optical design, as well as the cosmetic aspect of the scope.

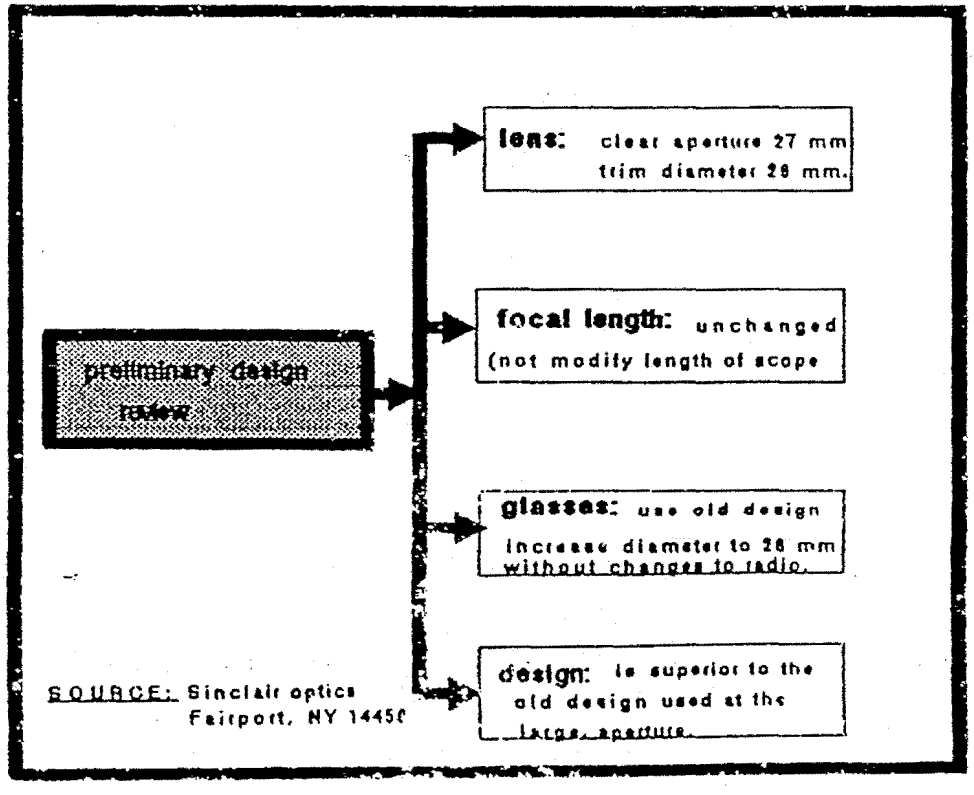


FIGURE # 13

Figure # 13 shows the preliminary lens, focal length, glasses, and design characteristics of the 2X6 EER Scope.

At present design engineering has already examined a model of the scope, taking it out in the field observing how it looks to the eye, and making subjective evaluations of its performance.

In order to more easily compare the 2X6 EER scope with existing scope designs, engineering uses standard graphical print outs of the design and performance specifications of the 2X6 EER Scope.

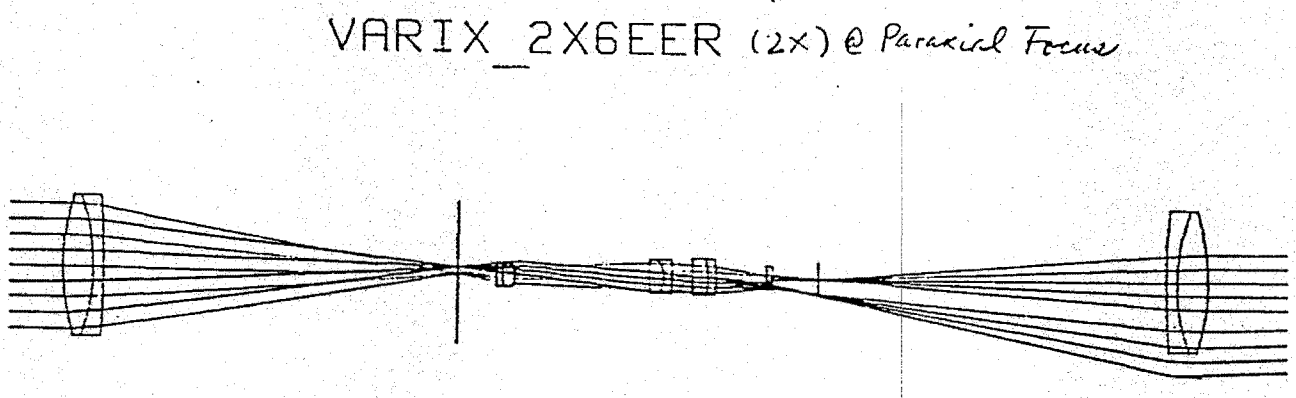


FIGURE # 14

Figure # 14 is a schematic diagram of the lens system without any of the mechanical support shown. It shows how light rays travel through the system.

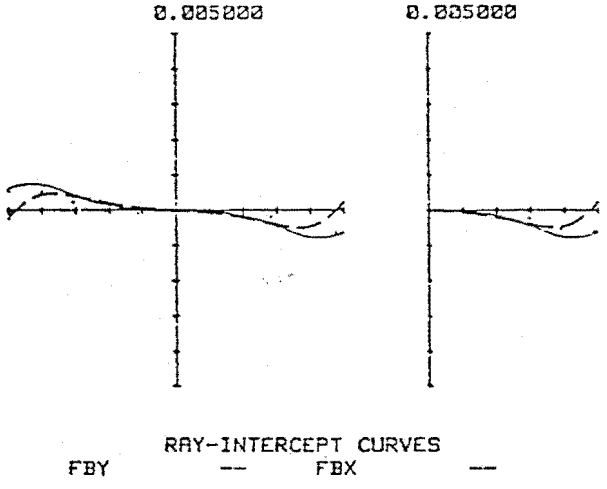
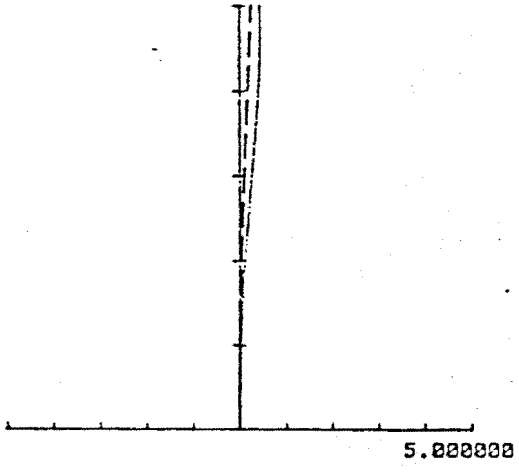


FIGURE # 15

Figure # 15 is a ray intersect curve. The more horizontal and closer the graph is to the horizontal axis the better the quality of the scope. Figure # 15 can be used to compare the 2X6 EER scope's ray intersect curve with that of existing scopes.



FIELD CURVES

FIGURE # 16

Figure # 16 is a field curve. Ideally the curve should be a straight vertical line on the vertical axis. Any deviation from this shows the amount of field curvature. Again the field curvature of the 2X6 EER scope can be compared with the standard field curve graphs of other scopes.

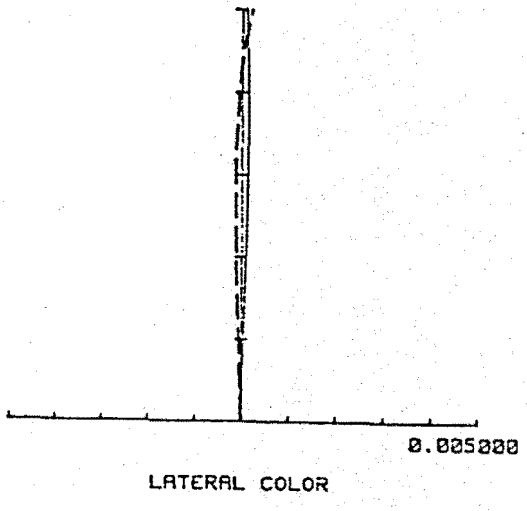


FIGURE # 17

Figure # 17 is a lateral color curve which shows the amount of chromatic distortion, or color separation of light, by the scope. Ideally the curve should be a straight vertical line on the vertical axis.

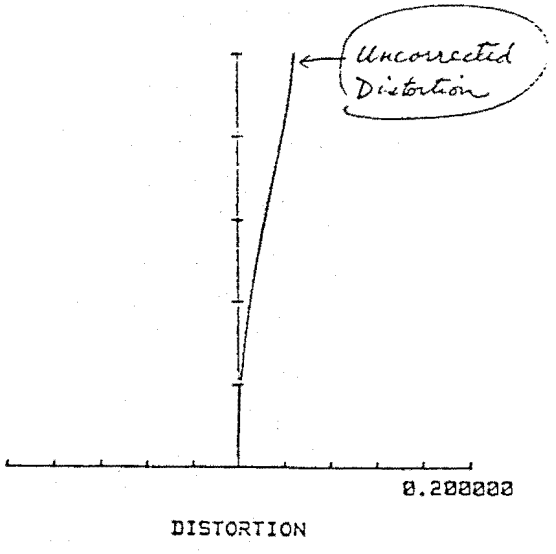


FIGURE # 18

Figure # 18 shows the amount of distortion of a standard grid pattern at the edges of the scope. The distortion measures the degree to which lines of the grid pattern would be curved when viewed through the scope. Ideally the graph should be a straight vertical line on the vertical axis.

These graphs show the 2X6 EER specifications in a manner which allows easy comparison with the graphs of other scopes. No scope is perfect and any design is a compromise of its various design elements.

3.2 Engineering Model Design

Engineering Model Design consists of drawings and dimensional sketches of the parts necessary to build the 2X6 Extended Eye Relief Pistol Scope. The sketches must be suitable for ordering model parts and for determining the parts' cost, and must be documented in the engineering log books. The log books reside in the engineering vault as part of the total documentation package.

Design engineering communicates with the rest of the company not only by memos, but also through drawings. Such drawings often start out as rough sketches.

From the preliminary design produced by design engineering, design engineering then makes sketches of the 2X6 EER Pistol Scope. These engineering sketches reside in the design engineering departmet at Leupold.

These sketches are in the " Proprietary Appendix ". That appendix is for reference only. It is not to be made available to readers of this report.

The next step is to take copies of these sketches and turn them over to the model maker to produce the engineering model. Once the 2X6 EER project has been approved, the model, and the engineering design specifications are sent to the engineering document support department, which will turn them into finished drawings.

The finished drawings of the 2X6 Extended Eye Relief Pistol Scope are given a 5 digit part number, and then will

reside in the engineering vault, and will be subject to all of the document control restrictions. The finished drawings are controlled by the document support department of Leupold, and are an official document.

3.3 Engineering Model Build

This is a meeting which focuses on buildability issues. Parts and assembly manufacturing personnel are the key contributors to this meeting. The goal is to settle any concerns regarding the ability to build the 2X6 EER in an efficient manner. Tooling/fixture requirements are clarified (not designed) at this time.

3.4 Engineering Model Test

Engineering Model Test consists of the testing of the models by the Project Leader, Marketing, and Quality Control to assure that the product meets the specifications in the Design Specifications.

After the designer assures himself, through testing of the model, that the 2X6 Pistol scope meets the specifications in the DS, he requests independent evaluation from Marketing and Quality Control. Marketing conducts an analysis of the model to assure that the product will satisfy the market needs. Quality Control's analysis is based on an evaluation Plan submitted previously to the Project Manager. The Designer, however, should not depend solely on the Marketing and Quality Control analyses to uncover product flaws.

During this period a demonstration is held by the

Project Leader to secure engineering model approval by Marketing.

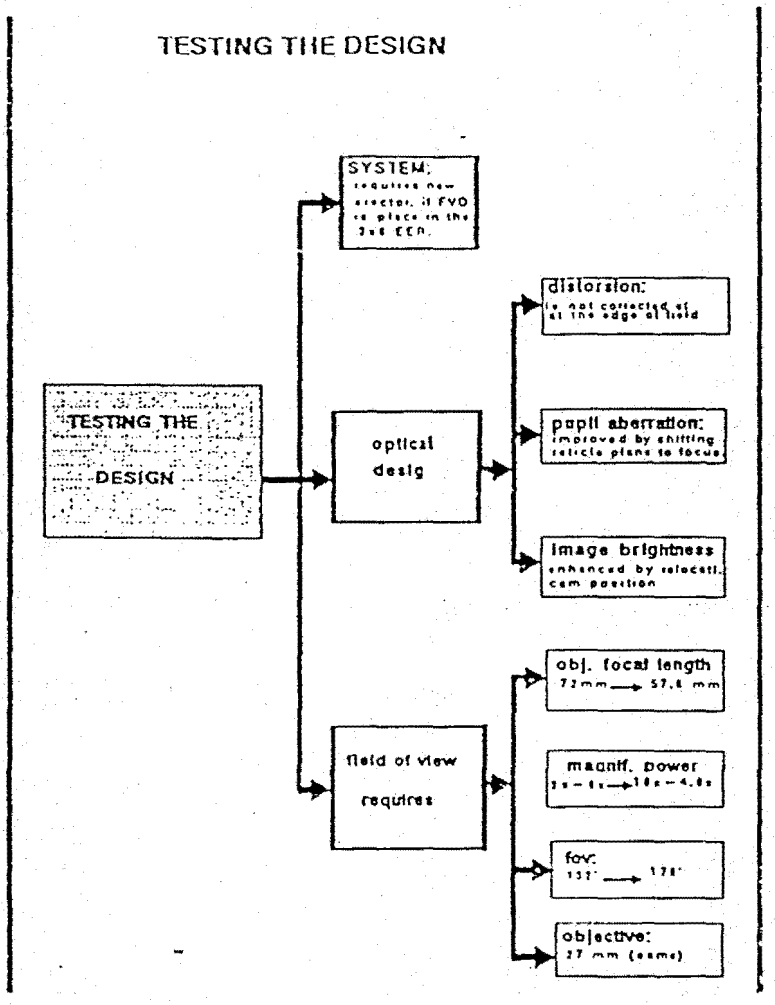


FIGURE # 19

Figure # 19 shows schematically the testing of the three major design factors of the 2X6 EER scope: i) the system; ii) the optical design; and iii) the field of view requirements. The figure shows for example that a new erector system was necessary. The last column of the figure shows the test standards for the various design factors.

3.5 Final design

Final Design consists of the completion of all design documents and a Design review.

3.5.1 Design Documents

The last of the drawings and other design documents are completed during this step. The final design is produced by the design department from the sketches produced by the design department and the model produced by the builder. These designs include: i) design drawings; ii) bills of materials; iii) tooling requirements; and iv) routines. These are the documents which will be used used in the preproduction and production of the 2X6 EER Pistol Scope.

3.5.2 Design Review

After all design documents are completed, a Design Review is held during which the Designer completes the Factory Test Specifications. Design Engineering, Manufacturing Engineering, Quality Control, and Marketing all participate in the design review. At this review of the 2X6 EER Pistol Scope, there is a complete evaluation of all aspects of the project, including design, production standards, marketing, and customer acceptance.

3.5.3 Prototype Build Release Meeting

This meeting is attended by the Project Team and

also factory management to determine whether all the requirements for an orderly pilot build are in place. These requirements include: i) Design Drawings; ii) Bills of Materials; iii) Tooling; iv) Routings; and v) Quality Evaluation Report (Engineering Model).

These documents are included in the " Proprietary Appendix ". That appendix is for reference only. It is not to be made available to readers of this report.

3.5.4 Quality Evaluation Report

To Leupold the quality of its products is of primary concern. This is true not only because of the importance of quality to its reputation and place in the market, but also because Leupold backs all its products with a lifetime guarantee. If its products are not of high quality there will be a substancial business expense associated with this guarantee.

Figure # 20 shows the quality evaluation program for the 2X6 EER scope. The scope is evaluated in three major areas: specification testing engineering; adjustment; and impact testing.

Specification testing engineering tests for clarity to make sure that the image throughout the field of division is sufficiently clear. The contrast between black and white images is also tested. A new product, like the 2X6 EER scope, is tested against Leupold's existing products. A new product must be at least as good or better than existing products which have proven

themselves in the marketplace.

Quality control evaluation of Adjustment refers to the mechanical assembly of the scope. All parts are tested to make sure they have been assembled using the proper torque, and that the scope such as the power selector ring operates properly under moving parts of extremes of hot and cold. The scope is also repeatedly tested for accuracy, since the scope will be guaranteed for life. Furthermore, the scope is also tested by an impact machine to simulate the severe impact imparted to the scope when it is mounted to a pistol.

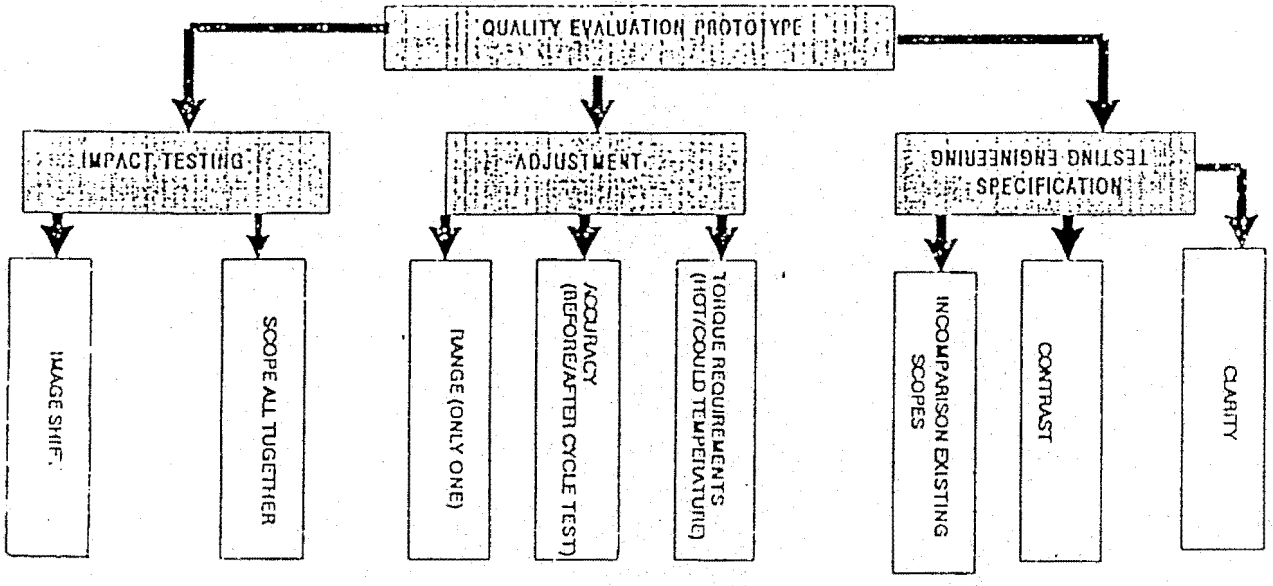


FIGURE # 20